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THE JOURNAL

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MINISTRY OF AGRICULTURE

Vol. XXVII. No. 1.

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NOTES.

The Future of Agricultural Machinery: A Stimulating Report.

THE Report of the Departmental Committee on Agricultural Machinery* may be considered to mark a new epoch in British farming. It is a recognition of the fact that old-fashioned methods will no longer suffice, and that if our food production is to be brought to the utmost point of efficiency, the farmer must employ the best mechanical power as an auxiliary to the skill which he has acquired by centuries of tradition. Not only must he have at his command machinery of the highest excellence, but he must know how to make the best use of it. By this means alone will it be possible to reduce the costs of production upon which the price of the nation's food depends.

The Committee, after a wide survey of the field and the examination of many witnesses, find the present position unsatisfactory. They make a series of weighty recommendations, which, if faithfully carried out, should prove of marked benefit to British farming. With regard to machinery, the Committee point out that hitherto manufacturers seem to have paid far too little attention to the principles of pure science underlying machine construction. The Report admits that a period of empiricism, during which the method is one of trial and error, is inevitable to the development of any science, but there comes a point beyond which such a rule-of-thumb will no longer serve the cause of progress. Hence the need for properly organised and systematic research in all branches of agricultural engineering. It is a fact that many of our industries, including even the small industry of confectionery, have set up their own Research Associations, although, singularly enough, nothing in this direction seems to have been considered by agricultural engineering, with the single exception, perhaps, of the tractor branch of the industry. It is assumed by the Report that a Research Institute on

* The Report of this Committee is noticed at p. 91.

(884). Wt. P. 6—198. 12,250 4/20. J. T. & S., Ltd.

Agricultural Machinery will shortly be established. The Committee expect that that body will be aided by any Industrial Research Association that may be formed in connection therewith. They advocate further the formation in this country of a permanent organisation to test agricultural machinery and implements, and recommend that such tests should be organised and carried out by the Ministry of Agriculture, and that both farmers and manufacturers should have an important share in the arrangements. A Central Advisory Committee is suggested, on which agriculture, agricultural engineering and a small official element should be represented. In this connection it is interesting to note that the witnesses before the Committee were unanimous in suggesting the initiation of such tests.

Excellent machinery, however, is of little use, unless farmers can readily acquire knowledge of it. At present they have to depend upon neighbours' opinions, interested agents' statements, Press notices, and awards of Agricultural Societies. The Committee recommend, therefore, that the Ministry should establish an Information Bureau which would collect descriptions and record performances of agricultural machinery and implements. A definite educational scheme is also proposed. Under this, instruction in mechanics, theoretical and applied, would be given in rural districts to youths under 14, while more specialised lectures would be available to farmers and kindred workers. College and Farm Institutes are also advised to equip themselves for practical demonstrations in agricultural machinery. A further part of the education scheme is the provision of expert advice, machinery demonstrations, and lectures illustrated by the cinematograph and lantern slides. Finally the Report urges that the Ministry should encourage this movement in every county or area, and presses home the need for co-ordination between all persons interested.

* * * * *

Development of Agricultural Machinery.

IN evidence given before the Departmental Committee of the Ministry* appointed to advise on the question of the development of agricultural machinery, successive witnesses referred to the change which the conditions produced by the War have brought about in the attitude of farmers in this country towards the use of machinery. While the introduction of the motor tractor was clearly foremost in

* See above.

the mind of most of the witnesses, it is evident that the last five years have introduced fresh elements into the whole problem. The shortage of labour caused by the withdrawal of man-power to the Army forced the farmer to place greater reliance on machinery, while at the same time the economic changes of the last few years have brought about a large advance in the wages of farm workers. We have to recognise also that the present comparative prosperity of the farmer has enabled him to purchase machinery more freely than he was able to do formerly. The factors which were in operation before the War, and which placed this country in a position of relative inferiority, so far as the use of machinery was concerned, to some others both in Europe and America, have not, however, been entirely eliminated.

Reasons for Unreadiness to purchase in the Past.—The unreadiness of many farmers in the past to adopt labour-aiding devices cannot, in the opinion of the Committee, be traced to any great extent to their unfavourable financial position, but is largely attributable to the cheapness of labour and to the influence of a tradition and social environment inimical to change, which was shared by all classes of the agricultural community. It is a commonplace of industrial history that low wages tend to stereotype methods of production, and agriculture has not been exempt from this tendency. Even so late as the beginning of the War, the self-binder had not been adopted in some arable districts of the country, and in not a few cases the tractor was regarded with unreasonable hostility and prejudice which even now have not entirely disappeared.

Incentives to Use of Machinery.—At the moment agriculture is passing through a period of transition. The farmer is, on the whole, in a better position to purchase machinery than he has been for many years, his outlook has been modified by his experiences during the War, and he has the stimulus of a heavy labour bill which, if he is to maintain his area under tillage crops, he can meet but in two ways—by obtaining a more efficient service from each worker, or by adding his labour costs to the price of his products. Of these alternatives, the Committee do not hesitate to suggest, only the former can be considered.

Influence of Machinery on Cost of Production and Methods of Farming.—Up to a certain limit the costs of production can be diminished by increased use of fertilisers or by improved methods of cultivation, but a large proportion of the land

in this country is already well and highly farmed, and although the Committee do not doubt that further efforts may be made in this direction, they consider that greater possibilities lie in increasing the efficiency of the worker by the extended and instructed use of labour-aiding machinery. Apart from the value of machinery as a means of reducing the cost of farming operations they emphasise the possibility of securing, by the application of improved machinery, an actual increase in production. The Committee received conclusive evidence of the great increase in power which machinery gave a farmer to carry on work whenever he found it most advantageous, or, in other words, when he would get the maximum production for the minimum of expense. To take the tractor as an example: this machine gives better opportunities for bastard fallows, early sowings and rapid harvestings, than horses do. In the past the farmer has often been compelled to sow at a time when he knew conditions were not really favourable; the tractor enables him to take full advantage of brief spells of favourable weather, to get his ploughing done in the late summer and early autumn, and to sow whenever he desires. On the farm attached to the Rothamsted Experimental Station it has been possible by using a tractor to reduce the amount of fallow cropping, to reduce the necessity for dead fallows, and to get winter oats in early and do away with the necessity for spring oats, which on the heavy land at the farm were almost invariably a bad crop. Further, wheat can be got in earlier, needing less seed for sowing and giving a better plant; and instead of being compelled sometimes to have rather too large an area under roots, it has been possible to have as much winter corn as was considered desirable. The introduction of machinery, moreover, makes possible certain operations, such as land drainage, which would otherwise be almost impracticable in many districts on account of the high price of manual labour.

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The Productiveness of the "New" Arable.

THE extensive breaking up of grass land during the War raised keen speculation as to the results of cropping and yield on the land so broken. To this question the Ministry has given close attention. For the second year in succession cropping reports on the land originally broken up for the cereal year 1917-18 have been called for, and forty-nine reports for forty-two geographical counties have been received. Unfortunately they omit three such large areas as Cornwall,

Lancashire and the West Riding of Yorkshire, all of which were fully reported for 1918.

The 1919 yield of all crops was the lowest within recent years. The returns from the new arable land reflect this and are uniformly below those of 1918, but not to the same degree as those obtained from the "old" arable.

Oats gave the best crop, wheat next, and barley third in order. The wheat yield for 1919 is practically equal to that of 1918. Oats grown on the new land averaged a bushel per acre higher than those from the rest of the arable. Barley declined only 0·8 of a bushel from the very low yield of 28·8 bushels in 1918, and was, all things considered, satisfactory.

Other cereals declined considerably. Root crops, on the other hand, while below the previous year, gave better results on the "new" arable than on the "old." Peas approached the average.

As the area under cereals had diminished and had been redistributed, the "new" arable had not by 1919 assumed its place in the normal rotation, an undue proportion having been retained under corn. For other crops the data are as yet insufficient to give a trustworthy indication, but the areas under beans, potatoes and roots seem to have slightly increased, while the average under mixed corn and peas has diminished.

* * * * * *

Demonstration Farm in Norfolk.

WITH the object of demonstrating how poor heath land can be improved by good husbandry, the Ministry last year purchased an estate of over 1,500 acres at Methwold in Norfolk, which will be known as the National Demonstration Farm of the Ministry. On this area, 1,043 acres are under arable cultivation, 43 acres are under grass, and 441 acres are waste heath. The estate is a stretch of typical Norfolk heath land in a poor state of cultivation, and in the past has been largely devoted to game It includes 200 acres of land previously under bracken, which have been reclaimed under the auspices of the Development Commissioners.

In farming this large area, the Ministry intends to continue the work of the reclamation of the bracken land and to make full use of labour-saving implements and machinery. The principal part of the scheme will be the improvement of the

land by chalking (chalk occurs near the surface at convenient points) and by the addition of organic matter. The latter will be supplied by folding sheep and ploughing in green manure. As the soil is notably deficient in potash, liberal dressings of this manure will be applied.

The scheme of demonstration also includes pig breeding and rearing on the open-air system, stock rearing, and poultry keeping. A feature of the cultivation of this land will be the growth of tobacco on a comparatively large scale. During the present season, the area under this crop is not likely to exceed 10 acres, but later this will be raised to 30 acres. Arrangements are being made to provide the plant necessary for the propagating and rehandling of the tobacco crop on an area of 35 to 50 acres. The objects which the Ministry has in view are:—(1) to supplement the experimental work carried out by the British Tobacco Growers' Society, Ltd., during the past six years, which has been aided by the Development Commissioners, and (2) to assist those small holders in the neighbourhood who may wish to grow tobacco on a small scale by providing a central station for the after-treatment of their crops. The character of the soil in the Methwold district is suited to the production of bright tobacco, and the crop may prove profitable to the local small holders who, while able to grow tobacco, are unwilling or unable to raise the plants or to devote the care necessary to the crop, without advice and supervision.

The treatment of the estate as a whole will probably elicit valuable information as to the possibilities both of large-scale farming and of small holdings—large-scale farming because the fields are large and well adapted to the use of modern implements and machinery, and small holdings because, if the conditions of the soil can be improved, the light and early character of the land would render it specially suitable for small arable dairy holdings, more or less on the lines of Danish farming.

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Cultivation of Land by County Executive Committees.

DURING the War wide powers were given to the Ministry to take over and cultivate land which, it was thought, was not being farmed to the best advantage. These powers were delegated to County Agricultural Executive Committees, and were exercised in practically every county in England and Wales. Possession of badly-farmed land was taken in over 1,000 instances, covering a

total area of about 64,000 acres. In a large number of cases the land has been let to suitable tenants for a period of two years after the termination of war, with a possible extension for a further period of three years. A great part of the land, however, has been kept in hand and farmed under the supervision of the Executive Committees. In some counties, such as Essex, Kent, Leicestershire and East and West Suffolk, practically all the land taken over has been dealt with in this way. The total area farmed either directly or indirectly by the Agricultural Executive Committees was at one time nearly 40,000 acres.

During the past year numerous farms have been inspected, and reports afford striking evidence of the beneficial results of action taken by County Committees. In Essex, for instance, land which was acquired as a building estate about twenty years ago and sold in small plots, was taken over by the Committee on behalf of the Ministry in the summer of 1917. It was overgrown with scrub, and barely sufficed to maintain a few cattle and sheep in store condition. Hedges grew wild, ditches filled up, and drains became blocked. Cultivation began in the early autumn, and by May, 1918, out of a total of 166 acres, 82 acres were already under crop, 33 acres were being bare-fallowed in preparation for wheat, and 49 acres were still in grass. The transformation effected on this land reflects the greatest credit on the management. Another case is that of a farm of 250 acres in Kent, which was entered on in March, 1917, and was in such a bad state that it was reported to be not worth cultivating. The farm was inspected in August, 1918, when it was found that 47 acres were under wheat, 15 acres under oats, 25 acres under barley, 14 acres under peas, 6 acres under clover hay, and 14 acres under vetches. This work was accomplished by the Committee with the minimum of expense, and even better results are expected this season.

When giving up a farm which has been entered, the Ministry has a statutory right to recover the value to the owner or an incoming tenant of the improvements effected; in a few cases this may amount to some thousands of pounds. The policy of the Ministry is to withdraw from possession subject to this right, provided that satisfactory arrangements are made for carrying on the cultivation of a farm, either by the owner himself or by a tenant, and a number of Agricultural Executive Committees are now withdrawing from land of which they had taken possession. In the case of Cheshire, for instance, the

Agricultural Executive Committee has since the beginning of this year withdrawn from 705 acres out of a total of 812 acres that were either being farmed by the Committee or were let by them to farmers at the end of 1919. The Ministry is still in possession of about 35,000 acres of land throughout the country, and in exceptional cases the power to enter on land which is either derelict or is badly farmed is still being exercised. The power under the Defence of the Realm Regulations will lapse in the near future, but Part IV. of the Corn Production Act, 1917, provides similar, though somewhat less drastic, powers. The Ministry is delegating its powers under Part IV. of the Act to the same Committees which functioned under Regulation 2M. Eventually these powers will be delegated to the County Agricultural Committees that are now being set up under the Ministry of Agriculture and Fisheries Act, 1919, and the enforcement of good cultivation will then become a branch of the county administration.

* * * * * *

Land Drainage.

DURING the year 1919 eight Orders under the Land Drainage Act, 1918, establishing new drainage authorities or extending the area of existing drainage authorities, were finally confirmed, the total area brought under their jurisdiction being 31,000 acres.* During the present year the Ministry has finally confirmed three similar Orders affecting a total area of, approximately, 22,000 acres. In addition, five draft Orders, concerning about 24,000 acres, have been deposited for public inspection, while two Orders affecting 37,000 acres have been sealed by the Ministry and now await final confirmation. There is reason for hoping that the Orders which have not yet been finally confirmed will become operative without any serious opposition.

Mention has already been made in this *Journal* (March, 1920, p. 1172) of a Provisional Order which the Ministry has settled and made, establishing a single authority for the whole of the drainage area of the Great Ouse and its tributaries, comprising 480,000 acres. The great size of this area, and the difficulties of reconciling the numerous interests concerned and of arriving at an equitable system of rating for the expenses of the Drainage Board, have been such as to render it necessary to submit the Order to Parliament for confirmation.

* A review of the work of the Ministry under the provisions of the Land Drainage Act, 1918, was published in this *Journal*, February, 1920, p. 1088.

Numerous applications have been received by the Ministry from drainage authorities for Orders increasing their rating and borrowing powers on the ground that the powers conferred by their local Acts are insufficient for the performance of their duties under post-war conditions. Since 1st January last, three Orders of this kind have been confirmed, and four others are expected to be confirmed shortly.

An Order has been confirmed transferring to the Lancashire County Council the powers and duties of four bodies of Drainage Commissioners in Lancashire; it is the only Order of this nature that has been made.

The Ministry has in hand the preparation of between 30 and 40 Orders establishing new drainage districts. These figures afford striking testimony to the need that existed before the passing of the Act of 1918 for the establishment of drainage authorities and also to the effectiveness of the machinery provided by that Act. The Ministry's policy is to treat whole river systems as administrative units, and to place each system under a single authority, experience having proved that where authorities having jurisdiction over parts only of a river system have been established, engineering and administrative difficulties have frequently arisen rendering effective drainage impossible.

* * * * * *

The Cultivation of a Moor in Cornwall.

WADFAST MOOR is situated near Launceston, Cornwall, about 500 ft. above sea level. During the last 100 years the land has fallen out of cultivation, and it is now covered with heather, gorse, sedges, rushes, and various forms of marshland vegetation. In places it is also badly waterlogged. The surface soil is mainly a dark-coloured loam from 5 to 8 in. deep, which rests on a subsoil of yellow clay. It is very sour and was found on analysis to contain a high percentage of organic matter, but relatively small amounts of available phosphate.

With a view to testing the possibility of growing oats on this type of land, the Cornwall Executive Committee decided, in 1918, to break up about 80 acres. Ploughing was commenced on 16th July, with Titan and Mogul Tractors and Davey-Sleep 2-furrow balance ploughs. At first an attempt was made to plough up and down the slope to facilitate drainage, but, owing to the tough nature of the turf and the rank herbage, the plough failed to turn the furrow. It was decided, therefore,

to plough across the slope, commencing at the bottom. The furrows, which were about 11 in. wide, and 6 to 7 in. deep, were all turned one way, to ensure the complete inversion of the sod.

The difficulty of securing adequate drainage was surmounted by using a Case Road Grader imported from the United States. This implement is widely used in the United States and the Dominions and was found quite effective for making open drains. It may also be usefully employed in cleaning out existing open drains and ditches.

After ploughing, the land was rolled twice, in order to ensure that the herbage should remain buried as far as possible. It was then twice disc-harrowed.

At this stage the land was allowed to lie fallow for 9 months until the following April, receiving no treatment except an application of lime at the rate of 1½ tons per acre. It was then again disc-harrowed twice with a Fordson tractor. The Committee decided to try seven different kinds of oats, a plot being set aside for each kind. Each plot was divided into three sections, in order that manurial tests could be made at the same time. The first section was manured with a mixture of 5 cwt. superphosphate and 1 cwt. sulphate of ammonia per acre (mixture "A"); the second with 3 cwt. superphosphate and 1 cwt. sulphate of potash per acre (mixture "B"); and the third was left unmanured.

Sowing was carried out during the middle of May, at the rate of about 4 bush. per acre; this was rather late, owing to wet weather and a difficulty in obtaining seed. The seven varieties sown were Victory, Golden Rain, Potato, Yielder, White Canadian Banner, Cornish, and American Black Tartar, the last three being obtained from local sources. Yielder and Golden Rain gave the best crops, followed by Victory and Potato. Yielder, however, had the advantage of being the first seed to be planted, while Potato was planted last. The Cornish varieties were all very late in maturing, and, moreover, did not give very heavy yields.

As regards the effect of manuring, "A" mixture gave the best results, possibly owing to the effect of the sulphate of ammonia, which enabled the crop to make a good start before the dry weather set in. "B" mixture gave fair results, the straw being of good length, but the crop was neither so thick on the ground nor so heavy in the ear as in the case of the "A" mixture plots. The unmanured sections in every case gave poor results.

FIG. 1.—Showing that no crop was harvested on the portion not manured.

FIG. 2.—Showing Golden Rain growing on land manured with "A" mixture.

FIG. 3.—Showing difference between ground manured with "A" mixture and that which was not manured.

It is interesting to note that although, as a general rule, the application of lime in Cornwall is supposed to have a harmful effect on oats, yet in these experiments no injury seems to have been caused to the crop, where lime was used in conjunction with other manures. In the sections which were limed, but otherwise unmanured, the oat crop was a total failure. As, however, the action of lime is slow-working in its effects, it is probable that the beneficial results of the liming would be noticed more in the 1920 season.

The results of the experiment seem to point to the value of certain early maturing varieties such as Yielder and Golden Rain for sowing in late districts, and further to the importance under such conditions of artificial manures, particularly superphosphate mixed with some sulphate of ammonia, for stimulating growth and hastening maturity.

The above experiment was initiated and supervised by Mr. Charles Nairn, Honorary Tractor Representative for Cornwall, and there is included in this account information communicated to the Ministry by Mr. W. Borlase, County Organiser.

* * * * * *

Cost of Butter Production.

AN investigation was undertaken by the Ministry of Food into the average cost of producing 1 lb. of butter on nine farms near Penzance for the week ending 26th February, 1920.

As the estimated average cost of producing 1 gal. of milk was found to be 3*s.* 0½*d.*, the average cost to produce butter, after allowing 6*d.* per gal. for skimmed milk, was estimated to be 5*s.* 0½*d.* per lb. during the period of investigation.

Five farms (marked X on the subjoined table) were nominated by representatives of the National Farmers' Union, and four farms were nominated by representatives of the Dockers' Union on behalf of the miners.

A representative of the Ministry of Food visited each farm for the purpose of obtaining full data in regard to the number of cows dry or in milk, the amount of milk produced, and the quantities and kinds of food fed to the cattle. It is to be regretted that the farmers themselves were neither aware of the total quantities of foods fed nor of the proportion given to the cows that were in milk or were dry, for which reason it has been an impossible task to arrive at the exact cost of production, although the conclusion arrived at may be regarded as approximately accurate.

For the purpose of this investigation, the market value of home-grown produce has been disregarded (with the exception of cereals), the estimated cost of production alone being taken into account as follows :—

Hay	£7 per ton.
Straw	50*s.* ,,
Roots	27*s.* ,,

Home-grown cereals at two-thirds of their market value and purchased concentrated foods at market value.

Labour has been based on the current local rate of wages.

No manurial value has been taken into account, because almost all foods were found to be home-grown.

The value of calves is almost exactly off-set by the cost of repairs, miscellaneous items, and delivery charges, and for this reason these items are not taken into account in the accompanying table. The value of grazing in cases where the cows were obtaining enough grass to effect a decrease in the ration fed was taken at 2*d.* per cow for the week, an estimate based on an annual rental of 50*s.* per acre per annum.

Depreciation has been estimated at the rate of £5 per cow per annum, to cover losses by death and disease and the difference between the purchase and sale price of animals bred or brought into the herd annually in order to maintain it. In the case of farm C no depreciation has been allowed, as pedigree stock is bred on this farm and enhanced prices are obtained for calves and for animals sold from the herd.

The average percentage of butter-fat content was 4·6 per cent., an unusually high percentage, due to the breed of cattle. As butter contains about 86 per cent. of butter fat, 2 gal. of this milk is converted into slightly more than 1 lb. of butter and slightly less than 2 gal. of skimmed milk. As there is a local market for skimmed milk at 6*d.* per gal., an allowance for this by-product has been made at this rate.

The proportion of dry cows to those in milk is unusually high, being 123 dry to 103 in milk. This is no doubt due to the natural desire of the farmers to produce butter during the summer when the cost of production is comparatively low, rather than during the winter, when the cost is high. This low proportion of cows in milk materially increases the cost of production above what it would cost in winter were the same proportion of cows in milk to those dry to be maintained during the winter and summer periods alike.

Summary of Cost of Milk Production.

	X A	X B	X C	X D	X E	F	G	H	I	Total.	Average.
Number of Cows:											
(*a*) In Milk ..	16	18	9	10	13	13	5	8	11	103	11·4
(*b*) Dry ..	12	11	26	18	6	13	8	12	17	123	13·7
Total ..	28	29	35	28	19	26	13	20	28	226	25·1
	gal.	gal.	gal.	gal.	gal.	gal.	gal.	gal.	gal.	gal.	gal.
Total number of gal. produced per day	20	29·33	13·8	16	18	11	14·5	12	21	155½	17·4
Average daily yield per cow in herd	·71	1·01	·39	·57	·95	·42	1·12	·60	·75		·69
Average daily yield per cow in milk	1·25	1·63	1·53	1·60	1·38	·85	2·90	1·50	1·91		1·51
	per gal.	per gal.	per gal.	per gal.	per gal.	per gal.	per gal.	per gal.	per gal.	per gal.	
Cost of production per gal. for all cows in herd.	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	*d.*	
(*a*) Labour ..	6·10	4·38	4·17	4·81	6·72	5·55	4·27	6·0	3·76	5·08	
(*b*) Food ..	16·80	23·53	23·76	22·15	21·31	37·40	25·79	31·45	36·87	26·56	
(*c*) Grazing ..	4·30	·29	5·07	·45	·31	—	—	—	—	1·16	
(*d*) Depreciation	4·65	3·28	—	4·50	3·51	3·19	3·00	5·55	3·13	3·42	
Total cost per gal.	31·85	31·48	33·00	31·91	31·85	46·14	33·06	43·00	43·76	36·23	
Average Fat Analysis	4·3%	4·44%	4·9%	4·6%	4·3%	4·8%	4·7%	4·6%	4·5%	4·59%	

Note.—A, B, C, D, E :—Farms nominated by National Farmers' Union.
F, G, H, I :—Farms nominated by Miners' and Dockers' Union Representatives.
In the case of Farm C, a deduction of one half the amount of concentrated foods used was made as the producer was fattening or preparing his stock for the pedigree market.

(*The National Food Journal*, 10th March, 1920.)

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Whey and Dairy By-Products.

The general shortage of foodstuffs during the period of the War drew the attention of the authorities to the great waste of whey that was taking place throughout the country. Owing to the fact that the present system is to collect milk at depots for the manufacture of cheese, large quantities of surplus whey have been allowed to run to waste. This has not only been a great loss to the nation's food supply but has also constituted a public nuisance by disorganising the treatment of sewage, and contaminating water courses (to the detriment of public health) and in some cases causing loss of live stock. Many thousands of pounds sterling have been lost annually in this way.

Whey is in itself a valuable food both for human consumption and for stock. When used as part of a ration pigs thrive on the food, and calves can also be reared on it satisfactorily,* but at the centres where there is the largest amount of whey

* See article in this *Journal*, April, 1919, p. 39.

available, a far greater number of stock would be required for its consumption than can be dealt with conveniently. It therefore becomes evident that it must be converted into such products as can be utilised for human food.

Whey contains a certain amount of butter fat, and this should be separated as soon as possible after the whey has been run from the curd. The amount of fat varies according to the method of manufacture, but usually 2 lb. to 3 lb. of butter can be made from 100 gal. of whey from factory-made cheese. With the exercise of proper care quite good butter can be made, but in the absence of such care the product may possess a peculiar flavour.

After the removal of the fat, the separated whey can be treated for the separation of lactalbumen, which is a valuable food.

After the separation of the lactalbumen, the whey can be evaporated and further treated for the separation of the milk sugar (lactose). Lactose, of which this country has hitherto imported the greater part of its requirements, is used largely in the manufacture of infants' and invalids' food and also for medicinal purposes and products.

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Increased Milk Production in Cornwall.

Progress continues to attend the efforts being made to induce County Education Authorities to pay attention to the general improvement of the standard of milk production in their areas. A number of counties are providing lectures and demonstrations in clean milk production.

As an instance of the effect of Co-operative Cheese Schools in encouraging local increases in milk production, a report lately received respecting the activities of the Camelford and District Co-operative and Dairy Society may be quoted.

Camelford is a district in North Cornwall where very little milk was produced previous to 1917, in which year a co-operative school was held at Camelford. This school resulted in the formation of a co-operative society; and the following are the data showing the quantities of milk dealt with :—

1917	.. ..	30,000 gal.
1918	.. ..	64,000 ,,
1919	.. ..	108,000 ,,

It is claimed that the increases in the quantity of milk dealt with by the Society are entirely attributable to increased cow-keeping in the district, and it is further reported that not-

withstanding the fact that the milk was either sold as milk or made into dairy produce, the number of stock raised in the district has also been increased; and the whole is taking place without any reduction in other farm produce.

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Production of Grade A Milk.

THE Food Controller, after consultation with the Ministry of Health and the Scottish Board of Health, has hitherto granted licences permitting the use of the designations Grade A and Grade B in connection with the sale of milk of high hygienic quality. All such licences lapsed on 14th March, 1920, and from that date the arrangements described below came into operation.

Under the terms of the Milk Order, 1920, the Food Controller has required that no person shall, on or in connection with any sale or offer for sale or proposed sale of any milk or in any advertisement, circular or notice relating to any milk, describe or refer to the same as Grade A (Certified) Milk or Grade A Milk, or use any designation of which the words Grade A (Certified) Milk or Grade A Milk form part, except under licence by the Ministry of Food.

The Food Controller is prepared to grant licences, permitting the use of the designations Grade A (Certified) Milk and Grade A Milk, provided that the milk in respect of which a licence is sought by the producer or the wholesale or retail distributor complies with certain conditions to the satisfaction of a representative of the Ministry of Health or of the Scottish Board of Health, or of any local authority acting on behalf of the Ministry of Health or of the Scot ish Board of Health, who will undertake the inspection of farms and other premises, An Inspection Repo t Card (H.M.L. 7) will be used in connection with the inspection of farms, and a minimum percentage of points will be necessary to qualify for licences.

All communications with reference to the matter should be addressed to the Secretary, Ministry of Food, 100, Cromwell Road, London, S.W. 7.

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Electro-pure Process of Treating Milk.

THE issue of the *Journal of Dairy Science* for September last contains an account of the electro-pure process of treating milk as a substitute for the more usual practice of pasteurisation as a means of preservation. This process makes use of a high voltage electric current for destroying organisms present in the milk and so enhancing its keeping

properties. It is stated that the machine when operated under regular conditions will give the desired results, but that for commercial purposes the product was not uniformly satisfactory, and that it was considered necessary for constructional modifications to be made in the machine before it could come into general use.

The following is a summary of the conclusions arrived at by the experimenters :—

1. The electro-pure process conducted under the conditions indicated in these experiments gives a very satisfactory reduction in the number of bacteria in good raw milk, and a satisfactory reduction in poor raw milk, and at the same time effectively destroys nearly all lactose-fermenting, endo-positive organisms in raw milk.

2. Milk issuing from the different units of the electro-pure machine is fairly uniform in bacterial count.

3. Electro-treated milk kept at 5° to 10° C. keeps well for about five days.

4. At room temperature electro-treated milk showed no change in 24 hours, but soured normally in 48 hours.

5. The destruction of bacteria in the electro-pure process is apparently due to the heat produced by the electric current rather than to the electric current itself. The electro-pure process furnishes a method for producing a very sudden high temperature for a brief period of time.

6. The precipitation of albumen by the electro-pure process at 70° C. is very slight, if any.

7. The time required for coagulation by rennin is decidedly increased after treatment by the electro-pure process at 70° C.

8. The electro-pure process at 70° C. apparently does not destroy the peroxidase in milk, but weakens the reductase.

9. The electro-pure process has no effect on the feeding value of milk.

10. From a practical standpoint the electro-pure machine in operation at this plant has not proved entirely successful in the long run. Modifications in construction must be made before the machine can be regarded as a commercial success.

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The Pig Industry.

Need for Increased Production.—In 1919 there were 2,914,000 pigs in the United Kingdom. On the basis of the consumption in that year, it is estimated that the number quoted would have to be increased by 6,700,000 (making a total of 9,614,000 pigs) to make the United Kingdom self-supporting in bacon and hams. The number reared in this country has seldom

exceeded 4,000,000 and is usually between 3,000,000 and 4,000,000 head. During the War, the pig stock in Continental countries was seriously diminished in numbers, and, prolific as the pig is, it will probably take two or three years at least for those countries to restore their stock of pigs to anything like their pre-war level. Denmark was one of the main sources of supply before the War, but it will be some time before exportation from that country approaches its former level. There is, therefore, every reason why cottagers and farmers in this country should increase their production of pigs. Pig keeping should, however, be conducted on an organised scale, particularly so far as cottagers are concerned. The Rural Industries Branch of the Ministry is showing how this organised effort may be made, and full particulars can be obtained on application to the Director of Rural Industries, 4, Whitehall Place, London, S.W. 1.

Grants for Boars.—Several pig insurance clubs in different parts of the country have recently approached the Ministry, which is advising clubs (already existing or in process of formation) as to the need of improving the breed of pigs.

A properly constituted society in promoting pig breeding may follow either of two methods :—(*a*) it may purchase a boar and place it in the custody of a club member ; or (*b*) the society may arrange with an owner—who need not necessarily belong to the club—to place his boar at the society's disposal on terms agreed. The owner must guarantee the service of not less than 20 sows belonging to members. Such owner will be entitled (1) to a payment from the society of not less than the amount of the grant from the Ministry, (2) to a fee of not less than 1s. per sow served ; and (3) to have not more than 6 of his own sows served by the boar, unless a greater number is sanctioned by the Live Stock Officer.

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Poultry and Eggs.

DURING the year 1913, nearly 144,000 tons of eggs, valued at over £9,500,000, were imported into the United Kingdom, in addition to nearly 14,000 tons of dead poultry, valued at nearly £1,000,000 At present-day prices, the value represented is over £30,000,000. In 1919, the imports of eggs were less by 100,000 tons, and dead poultry by 6,000 tons, but over £7,000,000 of dried and preserved liquid eggs were imported, mainly from China, as compared with only a negligible quantity in 1913. From Ireland Great Britain imported eggs and poultry during 1919 to the value of probably over £18,000,000. The grand total

of the imports of these two commodities by Great Britain during 1919 was, therefore, approximately £35,000,000.

The extensive import trade indicated by these figures should cause British farmers, small holders, allotment holders and even city dwellers to consider the prospects of developing the present home production of eggs and poultry, which is much below what is possible. In 1908, the latest year for which figures are available, the number of adult hens in Great Britain on holdings of one acre and upwards was nearly 17½ millions. There were, of course, in addition, considerable numbers kept by occupiers of less than one acre of land and by town residents.

An acre of pasture land will carry in addition to the ordinary farm stock—horses, cattle or sheep—at present grazed upon it, at least three laying hens, which will not interfere with the grazing of the other stock but will actually increase the growth of herbage. If suitable portable houses are used for the hens, and if they are removed to the corn stubbles in autumn and left there while cultivation is carried on until just before the seed for the succeeding crop is sown, the birds will find from 25 to 50 per cent. of the food they require in the form of grubs, worms, waste grain, etc. In addition, their manure will improve the soil and the birds will help to remove injurious grubs from the land.

Under semi-intensive conditions, *i.e.* where large laying houses are used providing 3 to 4 sq. ft. of floor space for each bird, from 200 to 400 hens may be kept on an acre of land, provided the land is properly cultivated, cropped and kept in sweet condition. The crops grown are usually forage crops, such as thousand headed kale, which provide necessary green food for the hens, and sometimes the runs are planted with bush fruit or standard fruit trees.

The town dweller also has opportunities for poultry keeping, and he possesses two special advantages: (1) eggs produced in the backyard can be distributed more easily, and involve little or nothing in transit charges; and (2) the householder's food scraps are put to an economic use, and reduce considerably the cost of feeding the hens. In a properly-constructed intensive house providing about 4 sq. ft. of floor space for each bird, country-reared pullets can be maintained under a proper system of feeding and management in healthy productiveness for at least a year, even though the birds may have no outside run whatever. Any town dweller with a small back garden can thus maintain a few laying hens in order to produce new-

laid eggs for his own table. Unless ample ground is available, however, it is better for the town dweller not to attempt rearing; he should purchase his pullets from a breeder in the open country.

It is essential that in every case a proper system of housing, feeding and general management should be studied and practised in order to obtain profitable results. One important factor necessary to success is that only hens that are bred from strains having a high egg-yield should be kept. There is a wide difference in the egg-producing capacity of individual hens, but the average yield from a flock of birds bred from carefully selected ancestors will invariably be greater than that obtainable from a flock of nondescript mongrels, given the same feeding and management. In view of the importance of this question the Ministry has, in conjunction with about thirty-eight County Local Authorities, arranged for the distribution, at moderate prices, of eggs for hatching and day-old chicks from high-class stock, at about 213 breeding centres in England and Wales, in order that poultry keepers who may not be in a position to pay high prices may have an opportunity of rearing good breeding stock for next year.

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Egg-Laying Competition of the Northern Utility Poultry Society.

AN egg-laying competition was held by the Northern Utility Poultry Society during 1918-19 on the Society's farm at Towneley, Burnley. The competition was divided into four sections, viz., Section 1 (White Leghorns), Section 2 (White Wyandottes), Section 3 (any other variety), and Section 4 (limited to small breeders, and in which White Wyandottes, Sicilian Buttercups, White Leghorns, Buff Rocks, and Rhode Island Reds entered). In all 107 pens of pure-bred poultry competed, and 5 pullets of one breed were allowed to each pen. The birds in Sections 1, 2 and 3 were kept in houses 12 ft. by 8 ft., divided in the centre, with grass runs, and those in Section 4 were housed in large runs.

The eggs laid were separated into three grades, according to weight, but only the two first grades were given a score value. Eggs weighing 2 oz. and over were classified as Grade 1, and those weighing during the first ten weeks less than 2 oz. but not less than $1\frac{5}{8}$ oz., and for the subsequent period of the test not less than $1\frac{3}{4}$ oz., were classified as Grade 2; not more than 100 second-grade eggs, however, were allowed to be

included in the pen score for competition purposes. The eggs for which no score value was allowed were placed in Grade 3.

The food during the test consisted of grain fed in the litter each morning, dry mash in hoppers at the manager's discretion, and wet mash in the afternoon.

The three highest scores in each section, over a period of 48 weeks, were as follows:—

		Total Eggs.	*Score Value.*
Section 1 (White Leghorns)	1st	1,144	1,082
	2nd	1,091	1,045
	3rd	996	996
Section 2 (White Wyandottes)	1st	1,099	916
	2nd	909	909
	3rd	920	863
Section 3 (any other variety)	1st (Rhode Island Red)	966	966
	2nd (Black Leghorns)	1,015	962
	3rd (Anconas) ..	791	791
Section 4 (small breeders)	1st (White Wyandottes)	947	947
	2nd (White Leghorns)	921	921
	3rd (White Wyandottes)	907	907

* * * * *

Tractor Trials, 1920.

TRACTOR TRIALS are being promoted by the Royal Agricultural Society and the Society of Motor Manufacturers and Traders. The entries are divided into seven classes. Three of these are for internal combustion tractors, one for steam tractors, two for cable ploughing sets (steam and internal combustion engines respectively) and one for "self-propelled ploughs." For each class a first prize of a gold medal and £20, and a second prize of a bronze medal and £10 are offered. The competitive aspect of the trials is, therefore, very pronounced, and the conditions of the trials will necessarily be in sharp contrast to those in force at Lincoln last year.* It remains to be seen whether the present method has any advantage over that adopted last year by the Society of Motor Manufacturers and Traders; but in any case opportunity will be provided for testing the two most obvious methods of conducting trials of short duration.

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* The general principles in regard to the judging at these trials are stated in the Report on the Lincoln Tractor Trials for 1919, a note on which appeared in last month's issue, p. 1174. An account of the trials was published in this *Journal*, October, 1919, p. 686.

Shoddy as Manure: Danger of Anthrax.

THE attention of farmers is directed to two recent cases of Anthrax which have a most important bearing on the dangers of employing shoddy as manure. British shoddy is comparatively safe, but foreign samples are likely to contain and disseminate the Anthrax spores. Farmers should use only shoddy guaranteed to contain no foreign element, or to have been properly disinfected.

In one case two sows died of Anthrax on a sewage farm. The farm land received from a neighbouring fleece-factory sewage mingled with the chemicals used in treating fleeces. The chemicals do not destroy the spores which may be present in the fleeces, and any infected sheep-skin would be a source of risk. The factory, though dealing chiefly with British fleeces, had recently received large consignments from abroad, including a quantity from South America. There is a strong presumption that these fleeces were the cause of the outbreak.

In the other case two cows fell ill. One was slaughtered and the other died under strong suspicion of Anthrax. Shortly afterwards a man who had handled the carcass of the slaughtered beast developed undoubted Anthrax. Both cows had been fed on mangolds and turnips grown on fields manured with shoddy. These two cases are sufficiently instructive.

* * * * *

Village Organisation.

AN extremely interesting experiment in village organisation is being made in the parish of Compton in Hampshire on the lines recommended by the Village Clubs Association. Situate amid the chalky Downs of Hampshire, and several miles from a railway station, the local residents have decided that the best way of improving the social and material conditions of the parish is by grouping all the village clubs and societies under a Central Council. The method adopted is to appoint representatives from each of the village organisations on the Central Council. Separate accounts will be rendered to the Council annually, and financial help will be given to any clubs or societies requiring it, the subscriptions made to the Council by local landowners and others interested being used for this purpose. The idea is not only to co-ordinate activities in the village, but also to give help where it is most needed. For example, the football club may find itself at the end of the year with a credit balance, while the cricket club may be slightly in debt. In such a case, financial assistance will be given to the cricket club to prevent its collapse. Similarly, a live-stock association will receive help, if needed, from the

same source. No attempt will be made to pool the funds of the various societies; a separate account will be kept of the finances of each organisation; local residents are entering with enthusiasm into the movement; and there is every prospect that the experiment will prove a model for adoption in other villages.

* * * * * *

The Value of Seaweed as Manure.

THE value of seaweed as manure is appreciated in many parts around the coasts of the British Isles. It is specially valued in Cornwall and Devon for early potatoes, cauliflowers and root crops; in the Isle of Thanet for lucerne, sainfoin, market-garden crops and ordinary farm crops; and in Jersey for early potatoes.

The use of fresh and dried seaweed on all farms near the coast during the present scarcity of farmyard manure is worth considering. Some species contain as much nitrogen as farmyard manure (although in a more slowly-acting form), and more potash, but less phosphate, so that it is advisable to add a phosphatic manure when seaweed is used instead of farmyard manure. It should be put straight on the land, or else mixed with dung or other material which will absorb some of the decomposition products.

Fresh seaweed cannot economically be used as manure at any great distance from the coast, as the expense of carriage of so bulky a product would make the cost prohibitive. To be used at all on inland farms it would either have to be dried and ground, or else burnt. It seems possible that the collection and burning of *Laminaria* and *Fucus* might repay attention.

Detailed information with regard to the composition and use of seaweed for manurial purposes is given in the Ministry's Leaflet No. 254.

* * * * * *

Control of Potatoes.

IN view of the shortage of potatoes, control of prices has recently been re-imposed by the Ministry of Food.

The maximum growers' price for ware potatoes (*i.e.*, potatoes which will not pass through a 1½ in. riddle) was fixed at £12 15*s*. per ton f.o.r. during the period 15th to 31st March, and thereafter the growers' prices were to increase fortnightly by 5*s*. per ton, rising on 1st June to £14 for the remainder of the 1919 crop. For potatoes other than ware potatoes, or for a mixture of ware and other potatoes, the maximum growers' price is £8 f.o.r. irrespective of the date of delivery.

Wholesale dealers will be permitted to average their profits in the same way as last year. The average profit over all transactions during the fortnightly period ending 28th March and each subsequent fortnightly period must not exceed 7*s.* 6*d.* per ton, where the potatoes are sold to another wholesale dealer, and must not exceed 15*s.* per ton where the potatoes are sold to a retail dealer or consumer. In addition, the wholesale dealer may charge any reasonable amount borne by him in respect of transport, and a sum not exceeding 10*s.* per ton for bags where these have been supplied by him.

The maximum growers' prices apply only to potatoes grown in Great Britain, and the Order does not prescribe any maximum first-hand price for potatoes imported from Ireland or foreign countries. On the other hand, the limitation of profits of wholesale dealers applies to all potatoes sold in Great Britain, whether home-grown or imported.

The Order does not extend to Ireland, and does not apply to potatoes sold as or for seed. In the case of potatoes sold for seed, the provisions of the Seed Potatoes Order, 1918,* must be observed.

All contracts (other than contracts for sale of potatoes in the ground) for the sale of potatoes subsisting on the date when the Order came into force (15th March, 1920) are cancelled, except in respect of potatoes delivered before that date.

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"Smut Diseases" of Wheat, Barley and Oats.

EVERY effort made by farmers this year to increase the acreage under corn as well as to obtain a better yield per acre will be for the nation's benefit. To achieve a better yield, much can be done by usng only seed that is of good quality and is free from disease.

Some of the most common cereal diseases are the "Bunt" or "Stinking Smut" of wheat; the "Covered Smut" of barley; and the "Loose Smut" of oats. So widespread are these becoming that probably every farmer is familiar with the appearance of the black, powdery spores which, adhering to clean grain carry infection over from year to year. Fortunately, infection can be prevented by dressing or "pickling" the seed before sowing.† For "Stinking Smut" in wheat, a solution of 1 pt. of commercial formalin and 20 gal. of water is the best preventive: or a solution of 1 lb. of copper sulphate (bluestone) of 98 per cent. purity and 10 gal.

* See this *Journal*, January, 1919, p. 1235.
† See also this *Journal*, October, 1918, p. 850, and December, 1919, p. 907.

of water might be used, though this is apt adversely to affect the germination of the seed. The solution may be poured over the grain spread over the barn floor, or the seed may be emptied into the vessel containing the solution and allowed to "steep" for 10 or 15 minutes. A slightly weaker solution of formalin, 1 pt. to 25–30 gal. of water, may be used as a preventive against "Covered Smut" in barley and "Loose Smut" in oats, but the duration of the soaking *should not exceed* 10 minutes. If the seed cannot be sown within a few hours after "steeping," it should be spread out on the barn floor in a current of air and thoroughly dried. The general adoption of these measures throughout the country will lead to a marked improvement of corn crops both in quality and quantity.

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The Wheat Bulb Fly.*

ONE of the worst, and at the same time the least often recognised, of wheat pests is the Wheat Bulb Fly (*Hylemyia coarctata*), stated to be now prevalent in Dorset. This pest is almost always responsible for considerable "thinning" of winter wheat during the spring, notably perhaps in East Anglia. Occasionally, however, it appears in sufficient numbers to cause an epidemic, when whole fields of wheat may be destroyed. Such an epidemic occurred in Cheshire in 1917.

The damage is caused by the maggot (or larva) of the fly which feeds within the growing shoot of the wheat. Each attacked shoot is killed, with the result that if the wheat is weakly or the maggots are very numerous, the whole plant dies. It should be noted, however, that if the wheat does not actually die, considerable recovery is possible owing to the powers of the plant to put out fresh tillers. A field which now or later looks very "seedy" may produce a very fair crop, and it is therefore unwise to decide too soon on ploughing. Naturally anything which can be done to stimulate rapid growth will increase the chances of recovery. With regard to re-sowing, barley is probably the best cereal to choose, since it is not attacked by the fly, and sowing can be deferred until it is clear that there is not sufficient wheat left to make a crop.

The habits of the fly are still not fully known, and hence it is difficult to advise other treatment. The maggots now feeding will turn to pupae (or chrysalides) in the soil, from which the flies will emerge in June. These flies live some weeks,

* See also note on p. 37.

but where they lay their eggs and what happens to the pest from July until the maggots are found in the following spring are problems which have not been solved. One thing seems clear, and that is that the nature of the crop preceding wheat has a definite influence. Wheat following potatoes, for instance, seems specially liable to attack, and the same is said, though with less evidence, of wheat after bare fallow. Further observations on this subject are very desirable.

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Wart Disease of Potatoes.

The Planting of Early Potatoes in "Infected" Areas.—The Ministry of Food recently estimated that, at the then rate of consumption, the remaining supplies of eating potatoes from the 1919 crop would be exhausted before the new potatoes for the 1920 crop are available. It is anticipated that in consequence there will be a very heavy demand on the latter as soon as they appear on the market, and it is desirable that the acreage planted with first early varieties be increased to the largest extent possible.

The possibility of such a situation had already been foreshadowed, and growers in the Eastern and Southern Counties have responded to it in a very laudable manner, large quantities of first early varieties being planted. Growers occupying land within those areas in which wart disease is widespread and common pointed out, however, that their willingness to co-operate was hindered by the marked shortage of stocks of first early immune varieties.

The Ministry, after careful consideration of this question, decided as a temporary measure to issue general licences authorising the planting in infected areas of *own-saved "seed"* of *any* true first early variety and also of those varieties recognised by the Ministry as of the "Eclipse" type, provided that they are planted on land on which wart disease has not occurred, and that they are grown and lifted as first earlies. Potato growers will not require individual licences for such planting. This concession does not extend the list of early varieties allowed to be introduced under licence by *bona-fide* market growers for planting in infected areas.

It was reported from many parts of the Midland Counties that, when sprouted and planted early, the second early immune variety "King George" grows quickly and can be marketed practically as early as "Epicure." "Seed" of "King George" was plentiful and its price much lower than that of first early varieties.

Certified and non-certified Stocks of Immune Varieties.—To prevent the introduction of any "seed" potatoes other than true and pure stocks of immune varieties into those areas infected with wart disease, the Ministry recently restricted such introduction to those stocks which had been inspected during growth and certified as satisfactory in those respects. The notification of this policy was, however, accompanied by the announcement that should the supplies of certified stocks be found insufficient to meet the demand, the Ministry would be prepared to licence certain non-certified stocks.

The results of careful investigation seemed to show that the certified stocks of "Golden Wonder" and "Kerr's Pink" were becoming exhausted, and the Ministry is, therefore, prepared to grant licences for the introduction into infected areas of non-certified stocks of these two varieties.

Applications for licences should be made to the Secretary, Ministry of Agriculture and Fisheries, 72, Victoria Street, London, S.W. 1. In the case of stocks grown in England and Wales, the potatoes will be examined before licences are granted. In the case of stocks from Scotland, licences will be granted subject to the inspection of the seed upon arrival at its destination, and without prejudice to any action the Ministry may think fit to take as the result of such inspection.

Merchants have been reminded that in the case of any sale of certified stocks or of licensed non-certified stocks, the relative certificate or licence number must be given to the customer in the invoice or other written document.

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Insect Pests and Plant Diseases.

THE technical advisers of the Ministry are giving careful attention to the question of preventing the introduction into this country of insect pests and plant diseases from abroad.

Several countries already possess the safeguards lacking in England; for instance, the United States and Cape Colony prohibit altogether the importation of plants except under special permit. Such a policy, if adopted in this country, would present obstacles to the development of agriculture and horticulture and would probably not meet with the approval of growers; while the alternative plan of placing potentially dangerous host plants in quarantine for a definite period is open to criticism on the grounds of expense and delay. The quarantine system, however, has many good points and might with advantage be adopted in this country. In any case, a system of inspection at ports of entry might be

made. In the case of imported gooseberries, such a system of inspection led to the adoption of a somewhat similar method of inspection by exporting countries, resulting in the despatch of much cleaner fruit to this country. If similar steps were taken in regard to nursery stocks arriving here from abroad, there would be good reason for expecting an improvement in quality and cleanliness. In addition, the danger of epidemics arising from the introduction of foreign plant enemies would be considerably lessened.

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Composition of Linseed Grown in Scotland.

AN account was published in the issue of this *Journal* for October last, p. 725, of the work of the Flax Production Branch of the Ministry with a view to encouraging the home cultivation of flax. An article published in the issue of the *Journal of the Board of Agriculture for Scotland*, October, 1919, gives a brief account of the work of the Flax Production Branch in 1918 in regard to the Fife centre (of about 1,300 acres) in Scotland, and contains some interesting facts in regard to the composition of the crop of seed produced.

It is stated that although the crop in Scotland was grown with the object of producing fibre, the seed also was saved, and the opportunity was taken of obtaining samples of the seed for analysis, particularly for the determination of their oil content, it being thought that it would be of interest to Scottish farmers generally to know what percentage of oil might be expected in seed grown in Scotland under these circumstances.

The Flax Production Centre issued full instructions* for the guidance of farmers prepared to grow flax in Fife, with the result that, within limits, the crop was raised under more or less similar conditions, more especially as to its place in the rotation, time of sowing and of harvesting, manuring, etc.

The seed supplied to the farmers was all from one source, being Dutch, a sample of which taken from bulk was found on analysis to have the following composition :—

Moisture	7·98	per cent.
Oil	39·20	,,
Albuminoids	22·19	,,
Fibre	5·33	,,
Ash	4·74	,,
Soluble Carbohydrates ..	20·56	,,
	100·00	

* See also note in this *Journal*, February, 1918, p. 1241.

The seed of the crops from which the samples of seed were obtained was sown broadcast either by hand or by machine at the rate of 126 to 140 lb. per acre in loamy soils that varied from light to heavy, and ranged in altitude from 100 to 560 ft. above sea level. The place of the crop in the rotation was in the large majority of cases after grass or grain stubble, and the manure applied consisted of 1 cwt. of sulphate of ammonia, with the addition in some casss of 2 to 3 cwt. of superphosphate of lime. All the seed was sown in the month of April and the crop harvested in August. Labour difficulties prevented the crop being harvested at the proper time in every case, with the result that on some of the farms the crop had gone a little beyond the required stage for fibre production at the time of harvesting.

The samples of seed received for analysis were of two kinds. The first represented linseed cleaned as far as it would be possible with the usual appliances that the farmer has at his disposal on the farm. A cursory examination of these samples showed that they varied greatly amongst themselves in the number of weed seeds they contained, and these on determination in the laboratory were found to make up from 2 to 14 per cent. by weight of the different samples, and to consist chiefly of *Polygonum Persicaria* (Redshanks), with dock, charlock, spurrey, and in cases a few Italian rye-grass seeds.

The following table gives the average percentage composition of 20 samples grown on different farms in Fife, together with the composition of the samples containing the minimum and maximum percentage of oil respectively :—

TABLE I.

——	Average of twenty Samples.	Sample containing minimum Percentage of Oil.	Sample containing maximum Percentage of Oil.
Moisture	12·35	12·40	12·96
Oil	32·49	27·50	37·50
Albuminoids ..	17·78	17·12	18·06
Fibre	7·43	9·00	6·50
Ash	4·12	3·40	3·74
Soluble carbohydrates ..	25·83	30·58	21·24

The wide variation in the oil content shown in the table is explained mainly by the presence, in different percentages in the different samples, of the weed seeds. A laboratory test was made as to the effect of the removal of these weed seeds

on the oil content, and it was found that in all the samples the removal of the seed raised the percentage of the oil content. Before removal, the average percentage oil content of the samples was 30·81 ; after removal, 34·60 per cent.

The second set of samples was finally-cleaned linseed, containing very few weed seeds, and the linseed themselves, having been graded in the cleaning, were much more even in size than was the case with the samples referred to in Table I.

The following table gives the average percentage composition of sixteen of these samples, together with the composition of the samples containing the minimum and maximum percentage of oil :—

TABLE II.

—	Average Percentage of sixteen Samples.	Sample containing minimum Percentage of Oil.	Sample containing maximum Percentage of Oil.
Moisture	8·66	9·00	9·06
Oil	36·15	34·74	38·55
Albuminoids ..	21·91	20·12	20·12
Fibre	6·78	6·00	5·95
Ash	3·75	3·60	3·78
Soluble carbohydrates ..	22·75	26·54	22·54

It will be seen that these samples differ but little in composition, the difference in the percentage of oil between the highest and the lowest being about 4 per cent. : the average percentage of oil in the 16 samples is about 36 per cent.

A comparison of the average percentage of oil in the samples tested in the laboratory as to the effect of the removal of weed seeds on the oil content with the average percentage shown in Table II. shows that the latter is a little higher owing to the removal, in the mechanical cleaning, of the smaller and the less mature linseed as well as the weed seeds.

The article states that it has frequently been maintained and often used as an argument against the growing of linseed in this country that British climatic conditions do not allow of the growing of linseed with as high a percentage of oil as that contained in imported seed. This belief has been shown to be quite incorrect, for at a number of English centres the home-grown seed has contained as high a percentage of oil, and in cases even higher.*

* See this *Journal*, June, 1915, p. 255, February, 1916, p. 1071, and July, 1919, p. 420.

In this connection the figures for the Scottish set are of interest, the average of the 16 samples of seed being 36·15 per cent., and the highest for one sample 38·55 per cent., as compared with the figures of 39·20 per cent. for this sample of Dutch seed already given (p. 27).

The average yield of dressed seed per acre in the Fife centre was 15 bush. (of 52 lb. per bush.). Such a yield, of seed containing on an average 36 per cent. of oil from a crop grown for fibre production, suggests that it might be advantageous for the farmer to cultivate the crop for the sake of the seed required for his own use.* At present prices it is stated that there seems to be little doubt that, where possible, it would pay the farmer to grow the crop for seed consumption on the farm, for when grown for this purpose the seed might be greatly increased.

In addition to the seed, a valuable by-product is obtained in the process of de-seeding, known as linseed chaff, which consists of the capsules or receptacles in which the seeds are contained.

The following table gives the analysis of four samples of linseed chaff obtained from different centres in Fife, the yield of chaff being on the average 7 cwt. per acre.

TABLE III.

Percentage Composition of "Linseed Chaff" Capsules.

Moisture	12·40	12·24	14·40	13·45
Oil	4·40	7·59	6·85	6·72
Albuminoids	5·00	6·25	7·19	6·85
Fibre	31·75	32·15	33·65	31·55
Ash	7·96	9·73	8·29	8·81
Soluble carbohydrates ..	38·49	32·04	29·62	32·62
Total	100·00	100·00	100·00	100·00

The samples are seen to vary slightly in their percentage of oil, due to the fact that all the samples contained a few small linseeds, some samples containing more than others.

One factor which has tended to discourage the cultivation of flax on a large area of land well suited for the purpose in Scotland is stated to have been the belief that the crop was a particularly exhausting one. This belief, however, has been shown to be erroneous, and figures are given in the article showing that the weight of nitrogen, phosphoric acid and potash removed from the soil by the flax crop grown in Fife is just about the same as that removed by an average cereal crop.

* It is pointed out, however, that when growing flax for the seed it bears, a different variety of seed—namely La Plata—should be grown, and the crop should be cut at a somewhat later stage of ripening. See this *Journal*, February, 1916, p. 1069.

SINCE last month a correspondent has kindly sent a sample of flax chaff, which has been analysed with the following results :—

Notes on Feeding Stuffs for May : ***From the Animal Nutrition Institute, Cambridge University.***

Composition of Sample of Flax Chaff.	*Per cent.*
Water	12·0
Protein	8·4
Fat	5·6
Carbohydrate	30·7
Fibre	29·7
Ash	7·6

This appears to be quite a useful feeding stuff, having approximately the same composition as pea haulm. It consists of the bolls from which linseed has been threshed out, and if, as seems likely, the growth of linseed in England spreads, considerable quantities of flax chaff will be available. There seems to be no information as to its digestibility, and no record of its practical use can be traced. Any information on this subject would be welcomed.

We have also received for analysis and comment samples of oat and wheat straw chaff which had been allowed to ferment by admixture with pulped roots. The composition of the original chaff and of the chaff after fermentation is shown by the following analysis :—

	Original Chaff. Per cent.	*Chaff after Fermentation. Per cent.*
Water	15·0	16·4
Protein	3·8	3·6
Fat	2·3	3·4
Carbohydrate	40·7	39·0
Fibre	32·6	32·4
Ash	5·6	5·7

The fermentation appears to have destroyed a little carbohydrate and protein. Some of the carbohydrate has apparently been converted into fatty acids as shown by the slight increase in the percentage of fat. There seems to have been no change in the percentage of fibre. Fermentation appears to have developed an appetising smell which would probably increase the palatability of the chaff, but the figures do not indicate that it has increased the nutritive value. It is proposed, however, to carry out a digestibility determination in order to throw further light on this point.

The practice of fermenting chaff in this way is not by any means new. It was employed by the late Mr. Samuel Jonas, and is described in the *Journal of the Royal Agricultural Society of England* for 1871. Mr. Jonas at first used chaffed greenstuff, such as clover, grass, vetches or trifolium, to set up the

fermentation, but subsequently pulped mangolds were used instead. Many other variations of the process have also been used, and are described in the issue of the same *Journal* for 1892. The present samples came from Herefordshire, where the practice is apparently common. The procedure is to trample down the chaff, and scatter over the surface first a thin layer of pulped roots, then a second layer of chaff again trampled down firm, and then another layer of pulped roots. After two or three layers have been placed in the barn in this way, the remaining space is filled with chaff, which is firmly trodden down. Fermentation begins at the bottom around the roots, and spreads upwards. The method at any rate effects a great saving of space in the storing of chaff.

Since last month the fall in prices has continued, especially in the case of cakes. Palm kernel, coconut and ground nut cakes are now reasonably cheap. The prices of feeding stuffs are now recorded in the weekly reports of market prices issued by the Ministry. From these prices the following costs per food unit have been calculated:—

TABLE I.—*Costs per Food Unit.*

	s.	d.		s.	d.
Brewers' grains (wet)	1	8½	–	1	9½
Palm kernel cake	1	11½	–	2	3
Coconut cake	2	7	–	2	8
Ground nut cake, decorticated	2	8½	–	2	9½
,, ,, ,, undecorticated	2	11			
Wheat sharps	2	11½			
Wheat middlings	2	11½	–	3	3
Distillers' grains (dried)	3	3			
Decorticated cotton cake	3	3½	–	3	8
Malt culms	3	4	–	3	7
Wheat bran	3	9	–	4	1
Cotton cake, Egyptian	3	9	–	4	3
,, ,, English	3	10	–	4	7
Rice meal	3	11			
Beans, Chinese	3	11½	–		
Linseed cake, Indian	4	1	–	4	3
Brewers' grains (dried)	4	1	–	4	5
Maize, Argentine	4	3	–	4	4
Linseed cake, English	4	3½			
Beans, English	4	4	–	5	3
Maize meal	4	9½	–	5	0
,, American	4	11½	–	5	0
Barley, feeding	5	0	–	5	8
Oats, Argentine	5	0	–	5	4
,, English	5	4	–	6	2
Peas, English maple	5	6	–	5	7½
,, Indian	5	9			

The cheapest feeding stuff on the market at the present time is fresh brewers' grains. Unfortunately, from its perishable nature, its use is very circumscribed. Of the dry foods palm kernel cake is the best value for money, its price being in the neighbourhood of 2*s*. per food unit. Coconut cake, ground

nut cake (both decorticated and undecorticated) and wheat sharps are all under 3*s*. per food unit. These make a good choice, from which rations suitable for most purposes can be compounded. Ground nut cake is a concentrated highly nitrogenous feeding stuff, containing also a fair proportion of oil. Palm kernel and coconut cakes are also concentrated foods less rich in protein and containing more carbohydrates. Wheat sharps supply a very large proportion of carbohydrates, mostly starch. The composition of these foods and most of the other dearer foods on the market is given in Table II., which has been revised in several details since last month.

TABLE II.—*Feeding Value of Common Feeding Stuffs.*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Name of Feeding Stuff.	Nutritive Ratio.	Per cent. digestible. Protein.	Fat.	Carbohydrates and Fibre.	Digestible Food Units per ton.	Starch equiv. per 100 lb.	Linseed Cake equiv. per 100 lb.
Foods Rich in both Protein and Oil or Fat.							
Ground nut cake ..	1 : 0·9	42·0	6·8	20·2	133	73	99
Soya bean cake ..	1 : 1·1	38·2	6·4	23·6	126	69	93
Decort. cotton cake ..	1 : 1·2	34·6	9·3	19·4	120	71	95
Linseed cake, Indian	1 : 2·0	27·8	9·1	30·1	115	74	101
Linseed cake, English	1 : 2·2	25·3	8·7	33·0	111	74	100
Cotton cake, Egyptian	1 : 2·0	17·6	5·1	22·0	74	42	56
Cotton cake, Bombay	1 : 2·3	15·6	4·5	23·3	69	40	54
Distillers' grains ..	1 : 2·9	19·6	10·2	30·1	99	57	77
Maize gluten feed ..	1 : 3·1	20·0	2·7	51·8	104	76	102
Brewers' grains, dried	1 : 3·8	13·0	5·6	34·9	77	48	65
Coconut cake	1 : 4·0	16·2	9·6	41·4	100	79	107
Palm kernel cake ..	1 : 3·7	17·1	6·8	43·6	98	75	101
Linseed	1 : 5·5	19·4	34·7	20·1	144	119	161
Bombay cotton seed ...	1 : 6·2	12·3	16·8	30·2	97	74	100
Fairly Rich in Protein, Rich in Oil.							
Maize germ meal ..	1 : 7·6	0·4	12·8	48·3	102	85	115
Rice meal	1 : 10·2	7·5	11·6	40·6	84	72	97
Rich in Protein, Poor in Oil.							
Fish meal	1 : 0·2	50·0	4·2	—	125	53	71
Peas, Calcutta white ..	1 : 2·1	23·3	1·1	45·9	97	70	94
Beans, English ..	1 : 2·6	20·1	1·2	48·2	97	66	89
Beans, Chinese ..	1 : 2·6	19·6	1·7	47·9	101	67	91
Peas, English maple ..	1 : 3·2	19·4	1·0	52·4	99	69	93
Palm-nut meal (extracted)	1 : 3·5	17·1	1·9	51·5	95	71	96
Brewers' grains, wet ..	1 : 3·3	5·5	2·4	11·5	30	18	25
Malt culms	1 : 3·9	19·9	1·5	43·6	88	43	59
Cereals, Rich in Starch, not Rich in Protein or Oil.							
Barley, feeding ..	1 : 11·4	6·5	1·2	64·7	82	71	96
Oats, English	1 : 7·9	8·0	4·0	47·4	75	59	80
Oats, Argentine ..	1 : 7·9	8·0	4·0	47·4	75	59	80
Maize, American ..	1 : 11·5	7·1	4·5	65·8	92	81	110
Maize, Argentine ..	1 : 11·3	7·1	4·5	65·8	92	81	110
Maize meal	1 : 14·6	5·5	3·5	64·8	85	78	105
Wheat middlings ..	1 : 4·6	13·2	3·0	53·8	91	72	97
Wheat sharps ..	1 : 4·4	13·8	4·3	50·5	92	64	86
Wheat pollards ..	1 : 5·2	11·6	4·0	51·6	87	60	81
Wheat bran	1 : 4·5	10·6	2·8	40·8	72	45	61
Wheat bran, broad ..	1 : 4·5	10·6	2·8	40·8	72	45	61
Locust bean meal ..	1 : 22·1	4·0	0·7	69·2	80	71	96

Imports and Exports of Feeding Stuffs and Fertilisers.

IN the issue of this *Journal* for last month (p. 1236), the import trade of this country in regard to food products was briefly reviewed. The improved situation in the feeding stuffs and fertilisers market is also a matter of direct concern to the British farmer, and the figures for 1919 have a particular interest as showing the very substantial recovery which has been made. Imports show an increase in the case of every feeding stuff, and every fertiliser except phosphate of lime and rock phosphate, while exports of fertilisers increased to the extent of 155 per cent. compared with 1918.

Feeding Stuffs.—The improvement in the feeding stuffs situation is well borne out by the figures in the following table :—

Imports of Feeding Stuffs.

Description.	Quantity.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
				£	£	£
Cotton seed tons	461,598	337,490	615,332	9,773,600	6,469,762	4,648,617
Flax seed or linseed .. qr.	2,764,559	1,309,631	3,274,062	20,662,835	8,158,170	7,195,399
Rape seed .. ,,	397,363	292,442	265,560	2,707,832	1,662,008	531,725
Soya beans .. tons	61,565	—	76,452	1,640,639	—	635,747
Nuts and Kernels for expressing oil .. ,,	499,856	443,411	81,120	19,411,392	12,696,553	1,933,052
Oil seed cake cwt.	278,274	10,828	406,700	5,821,558	210,034	2,539,892

Cotton seed came principally from Egypt, linseed from British East Indies and the Argentine, and rape seed from British East India.

Fertilisers.—Besides her imports the United Kingdom carried on before the War an export trade which in 1913 totalled over 700,000 tons, and £5,745,000 in value. The War, as might be expected, caused a reduction in the quantity exported, which diminished in 1918 to 60,089 tons. An increase to 153,064 tons, has, however, taken place during 1919. In regard to imports, there is an increase in the quantity of all fertilisers imported except phosphate of lime and rock phosphate. The quantities and values imported and exported during 1919, 1918, and 1913 are given in the two tables hereunder :—

Imports of Manures for Home Consumption.

Description.	Quantity.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	tons.	tons.	tons.	£	£	£
Basic slag	1,697	—	51,133	10,640	—	102,114
Bones, burnt and unburnt	13,023	5,144	40,685	177,104	121,982	219,637
Guano	101	—	25,548	1,250	—	149,189
Nitrate of soda	24,485	300	140,926	514,525	6,000	1,490,669
Phosphate of lime and rock phosphate	351,817	464,872	539,016	1,325,511	1,948,543	874,166

Exports of Manures Manufactured in the United Kingdom.

Description.	Quantity.			Value.		
	1919.	1918.	1913.	1919.	1918.	1913.
	tons.	tons.	tons.	£	£	£
Sulphate of ammonia ..	94,435	19,150	323,054	2,267,474	480,744	4,390,547
Superphosphates	4,026	2,547	63,480	38,581	16,421	166,314
Basic slag	13,699	1,065	165,100	54,802	3,638	261,972
Others	40,904	37,327	152,437	574,160	420,216	926,656

* * * * * *

Potato Growing.

The Need of Increased Production.—In view of the shortage of potatoes it is earnestly to be hoped that a greater area will be planted this year than was the case in 1919. Potatoes, doubtless, are an expensive crop to grow. They play, however, such an important rôle on the farm and in the national economy that it behoves all with facilities for the purpose to produce at least their own requirements. In addition, they should endeavour to raise sufficient to meet the needs of those whose circumstances compel them to look to the market for their supplies.

At the present time, when much of the land has become impoverished and foul as a result of war-time cropping, the potato crop offers both a means of cleaning the land effectively and of restoring its fertility. Even some of the heavier lands, not generally regarded as suitable for potatoes, work fairly freely, while the residues from the old grass turf remain.

It is, further, a point worth considering whether even a small crop, combined with all the advantages and effects of a fallow, is not more profitable than allowing the land to be bare for the purposes of cleaning.

The main essentials for success in potato growing are :—

(1) the use of good "seed," preferably not more than "once grown," from Scotland ;
(2) adequate manuring;
(3) early planting.

1. As regards "seed," varieties immune from Wart Disease should be largely planted even in districts where this disease has not appeared. The results of numerous experiments show that from the list of immune varieties a selection may be made of kinds to suit both the grower and the consumer.

2. Potatoes repay liberal manuring. An average dressing is 10 to 15 tons of dung, 1 to 1½ cwt. of sulphate of ammonia,

3 to 4 cwt. of superphosphate and 1 cwt. of sulphate of potash or its equivalent per acre. Where no dung is available the quantities of artificial manures should be increased to 2 cwt. of sulphate of ammonia, 6 cwt. of superphosphate and 2 cwt. of sulphate or muriate of potash. Manures should not be used in greater quantities than those included unless it is known to be profitable to do so.

3. With regard to planting, it is important that the first sprouts should suffer no damage. This can be obviated by boxing and careful handling; but if boxing is impracticable the aim should be to let the plants form their first sprouts in the soil. In early planting there is practically no danger from frost. As long as the soil is cold the tubers make less progress than they would do in boxes, and on light or lumpy soils in a dry climate early planting largely obviates the risk of drought.

Leaf Curl of Potatoes.—Although from 10 to 14 tons of potatoes per acre is no uncommon crop in various parts of the country, the average return is only six. To some extent this wide variation is due to climatic and manurial influences, but in many cases light crops are due to the use of inferior seed.

For the grower who makes use of obviously diseased and blemished seed there is no excuse, but it is unfortunately impossible to detect seed affected by the disease known as "Potato Curl Leaf," one of the "deterioration" potato diseases which can seriously reduce the crop. This complaint is more common in the drier and warmer parts of the country and is specially prevalent where mature seed, obtained from fully-ripened plants, is used.

As the disease is hereditary, it is of the utmost importance to avoid sowing seed from dwarfed plants or even from healthy-looking plants in plots or fields in which the potato leaf curl is common.

Where immature potatoes are used for seed each year, the disease is very rare. Growers will find that the planting of good seed potatoes, obtained from the more northerly parts of the country, will constitute the best insurance against the occurrence of Leaf Curl in their crops.

Further information regarding Potato Leaf Curl is given in the Ministry's Leaflet No. 164.

Notes on Manures for May:
From the Rothamsted Experimental Station.

The Wheat Bulb Fly and Nitrate of Soda.—There is some evidence that dressings of nitrate of soda are helpful to wheat crops attacked by the Wheat Bulb Fly (*Hylemyia coarctata*) provided that the injury has not gone too far. The nitrate helps by enabling the plant to send out new shoots and thus to keep going until the danger of the attack is passed.

Manuring for Potatoes and Root Crops.—Many experiments have shown that a good dressing for potatoes grown in the ordinary way is 10 to 15 tons of dung supplemented by 1 cwt. sulphate of ammonia, 4 cwt. superphosphate, 1 cwt. sulphate or muriate of potash. Where, however, there is reason to anticipate a yield of more than 7 or 8 tons of potatoes per acre the quantities of fertilisers should be considerably increased —the superphosphate up to 7 cwt. per acre, and the potash up to 2 or even 2½ cwt. per acre. Increases in ammonia, however, must be carefully considered; if the dung is rich and made with cake, probably 1½ cwt. sulphate of ammonia is as much as can safely be given. In most cases, however, owing to a shortage of cake the dung is likely to be poorer than usual, in which case sulphate of ammonia can be increased up to 2½ cwt. per acre.

In Cheshire steamed bone flour proved better than superphosphate, and where it can be obtained at about £14 per ton it makes an economical fertiliser for potatoes; it can be applied at the rate of 5 cwt. per acre.

The potato crop seems to need phosphates particularly on the Fen soils and in the West, where the rainfall is high and the soils rich in organic matter. In the Eastern Counties, however, on sands and silts containing small quantities of organic matter, it is doubtful whether heavy dressings of phosphates are necessary; probably no more than 4 cwt. would ever be needed. Where potash can be obtained at anything from 8*s.* to 10*s.* per unit it should be used for potatoes this season, owing to the fact that the soils have become somewhat depleted of potash during the War. Several potash salts are now available; the muriate at £22 per ton (50 per cent. of potash) costs 8*s.* 9*d.* per unit, whereas £24 per ton for sulphate (48 per cent. of potash) corresponds to 10*s.* per unit.

Where potash is unobtainable the omission may not be serious in cool, moist districts; nevertheless, anyone who wishes to make sure of his potato crop will be well advised to use a potassic fertiliser.

Mangolds.—The mangold crop is one of the most responsive on the farm to good treatment, and is capable of giving more produce per acre than any other. Naturally this is only possible where manuring is liberally practised. A suitable dressing is :—

Up to 20 loads of dung.
1 cwt. sulphate of ammonia.
2 to 4 cwt. superphosphate or basic slag.
4 cwt. kainit or 1 cwt. sulphate or muriate of potash.
2 to 4 cwt. salt in the drills.
1½ cwt. nitrate of soda as a top dressing when the plants are hoed and singled.

In moist districts basic slag may be used instead of superphosphate, but in the Midlands and southern parts of England superphosphate is the better fertiliser.

Swedes and Turnips.—The amount of manure which can be supplied to these crops depends on the yield that can reasonably be expected. In the southern parts of England it is not usual to obtain more than 12 to 15 tons of roots per acre. In such cases it is not advisable to spend too much on manure, and the most suitable dressing is 3 or 4 cwt. of superphosphate, with a little sulphate of ammonia or nitrate of soda to give the plants a good start and help them to grow away from the flea beetle. The advantage of phosphate is that a good development of root is secured and the feeding value is also enhanced. Experience all over the world shows that the quality of crops of very varied kinds is increased by the use of phosphatic fertilisers. In cases where there is the likelihood of drought in the early summer, it is desirable to use farmyard manure in order to improve the water-holding capacity of the soil. The full benefit of the manure, however, is obtained only when it has been worked into the soil during the winter so as to give it time to decompose. Professor Somerville has shown that swedes and turnips do not generally respond to combinations of farmyard manure and artificials, therefore little benefit can be expected apart from the effect on the moisture-holding capacity of the soil.

Where larger crops can be expected as in the north and west of England and in Scotland larger dressings can be given. The superphosphate can be increased to 5 or 6 cwt. per acre and the sulphate of ammonia to 1 or 1½ cwt. In place of superphosphate it is often possible to use basic slag, and nitrolim can be substituted for sulphate of ammonia. Potash is not usually needed except on peaty soils, where 1 cwt.

of muriate of potash or 4 cwt. of kainit should be given. Most farmers will use farmyard manure in addition to fertilisers for their swedes owing to the importance of securing a good tilth, but if there is any shortage it is better to reserve the dung for the potatoes and mangolds.

In cases where finger-and-toe prevails basic slag should be substituted for superphosphate; lime also should be applied, but dung should be omitted. It has been shown that the disease can be transmitted through the dung and that the organism will not flourish in well-limed soils.

Cabbages, etc.—These leafy crops require more nitrogen than almost any other crop, and in favourable situations they respond to large dressings of artificials. The mixture recommended for mangolds may be used, but the quantity of nitrate of soda may be increased according to the value of the crops, as much as 10 cwt. per acre being applied in certain extreme cases.

In the Bedfordshire experiments on light, sandy soil the highest yield of Brussels sprouts, amounting to 696 stones per acre, was given by 7 cwt. superphosphate, $1\frac{1}{4}$ cwt. sulphate of potash, and 4 cwt. nitrate of soda. On the heavier Oxford clay the potash could be omitted, but the nitrate and phosphates were still wanted.

In the Devon experiments with cabbages the best top dressings were found to be $\frac{3}{4}$ cwt. sulphate of ammonia at the time of planting, then 1 cwt. nitrate of soda applied 5 weeks later. Yields were:—

	Per acre.	
	Tons	*cwt.*
Superphosphate, kainit and salt, but no nitrogen ..	20	$14\frac{1}{2}$
Superphosphate, kainit and salt, with $\frac{3}{4}$ cwt. sulphate of ammonia and 1 cwt. nitrate of soda	41	$1\frac{1}{2}$

It is not unusual to give a little nitrate a few days before marketing so as to improve the colour of the crop.

Rape and other Fodder Crops to be fed off by Sheep.—Two rules are important: (1) Phosphates increase the feeding value; (2) Nitrgenous manures increase the bulk. Suitable dressings are:—

4 to 6 cwt. superphosphate or basic slag, 1 to 2 cwt. nitrate of soda or sulphate of ammonia.

POTASH FERTILISERS:

THEIR VARIETIES, COMPARATIVE VALUE, AND APPLICATION.

THE more usual potash fertilisers are Kainit, Muriate of Potash and Sulphate of Potash, together with "Potash Salts" of varying percentages, and Blast Furnace Flue Dust. All potash manures should be valued according to their content of potash (K_2O), but in the case of muriate of potash the percentage of chloride of potash (KCl) and in the case of sulphate of potash the percentage of sulphate of potash (K_2SO_4), are sometimes quoted. Invoices, however, should always state the percentage of potash (K_2O).

In order to compare the values of the different forms of potash manures, it is customary to divide the price per ton by the percentage of potash. The result is called the "unit price," which forms the best basis of comparison. On the basis of the market prices shown below, the "unit prices" will be found to work out as follows :—

——	Potash K_2O. Per cent.	Price Per Ton.	Unit Price.
		£ s. d.	s. d.
Kainit	14	7 0 0	10 0
Potash Salts	30	12 15 0	8 6
*Muriate of Potash, 80 per cent. KCl = ...	50	20 17 6	8 4
*Sulphate of Potash, 90 per cent. K_2SO_4 = ...	49	23 7 6	9 6

* To reduce chloride of potash (KCl) to potash (K_2O), multiply by 94 and divide by 149. To reduce sulphate of potash (K_2SO_4) to potash, multiply by 94 and divide by 174. The reason for this rule is that it takes 149 lb. of KCl or 174 lb. of K_2SO_4 to supply 94 lb. of K_2O.

Fertilising Value.—The relative quantities of each manure to be applied will depend mainly on the percentage of potash, though there may be reasons, referred to below, for preferring one form of potash to another.

Sulphate of potash, it will be noticed, is $3\frac{1}{2}$ times as rich in potash as kainit, and, therefore, $3\frac{1}{2}$ cwt. of kainit would need to be used in place of 1 cwt. of sulphate of potash, and, conversely, where 1 cwt. of kainit is required, only 32 lb. of sulphate would be needed.

This can be expressed in tabular form. By reading the following columns downwards the amount in pounds of any one manure equal to 1 cwt. (112 lb.) of any other manure can be

seen. Sulphate and muriate of potash may, for practical purposes, be regarded as equal in potash content :—

Manure and Potash Content per cent.	Kainit (14).	Potash Salts (30).	Muriate and Sulphate of Potash (say 50).
	lb.	lb.	lb.
Kainit (14)	**112**	240	400
Potash Salts (30)	52	**112**	187
Muriate of Potash } (50) ..	32	67	**112**
Sulphate of Potash }			

SUGGESTIONS FOR APPLICATION OF POTASH TO CROPS.

Potatoes.—Shortage of potash is probably felt more severely in the case of potatoes than of any other farm crop. The light loams, the gravels and sands on which potato growing has developed so much in recent years are typically poor in potash. Growers, therefore, should endeavour to apply potash in one or other of the forms already mentioned.

**Usual Application* = 1 to 2 cwt. sulphate of potash, or 185-370 lb. 30 per cent. potash salts.

Mangolds.—Mangolds respond well to dressings of salt, and there is reason to believe that for a season or two salt can replace most of the potash usually given, especially when the normal quantities of farmyard manure are applied. The time seems now ripe, however, for testing the effect of a little potash in addition, particularly on the lighter classes of soil.

**Usual Application* = 3 to 6 cwt. kainit, or 156 to 312 lb. 30 per cent. potash salts, or 96 to 192 lb. sulphate or muriate of potash.

Turnips and other Green Crops.—

**Usual Application* = 2 to 4 cwt. kainit, or 104 to 208 lb. 30 per cent. potash salts, or 64 to 128 lb. sulphate or muriate of potash.

Cereals.—Generally speaking, potash manure is not much required by cereals. Wherever land is known to benefit from potash fertilisers—usually light land and peaty soils—a dressing may well be tried.

Usual Application = 2 cwt. kainit, or 104 lb. 30 per cent. potash salts.

* Where an average dressing of dung is given, the smaller quantities of the manures mentioned should be used.

Leguminous Crops.—

Usual Application = 2 to 4 cwt. kainit, or 104 to 208 lb. 30 per cent. potash salts, or 64 to 128 lb. sulphate or muriate of potash.

Grass Land.—On grass repeatedly cut for hay the quantity of potash which can be liberated in the soil is probably already very low. In such cases potash must be applied, and, if this cannot be done by feeding on the land mangolds or other foodstuffs containing potash or by applying farmyard or liquid manure, potash in some other form should be given.

**Usual Application* = 2 cwt. kainit, or 104 lb. 30 per cent. potash salts, or 64 lb. sulphate or muriate of potash.

The potash manures recommended above should be given in addition to the other manures recommended in Food Production Leaflet No. 33, except where that leaflet prescribes blast furnace flue dust, in which case the applications of kainit, etc., now recommended, are to be understood as taking the place of flue dust.

Choice of Potash Manures.—As a rule, in deciding which form of potash to use, the main determining factors should be the price per unit and the cost of transport. For potatoes and perhaps young "seeds," sulphate or muriate of potash is generally to be preferred to kainit. Other crops respond about equally well to all forms.

Purchase of Potash.—Supplies of the following grades of potash fertilisers are now, or will shortly be, available :—

Kainit	14 per cent.	K_2O	
Potash Salts ..	20 ,,	K_2O	
Potash Salts ..	30 ,,	K_2O	
Muriate of Potash ..	80 ,,	KCl	= 50 per cent. K_2O.
Sulphate of Potash ..	90 ,,	K_2SO_4	= 49 ,, ,,

For the 30 per cent. potash salts, muriate of potash and sulphate of potash, maximum prices are in force. Full particulars are contained in Leaflet No. F.P. 501/S.1, which can be obtained free of charge on application to the Ministry, 72, Victoria Street, London, S.W. 1.

Farmers who wish to purchase supplies of potash should place their orders with their usual dealer or co-operative society.

(*This article is also issued as Leaflet No.* 335.)

* Where an average dressing of dung is given, the smaller quantities of the manures mentioned should be used.

NITRATE OF LIME:

ITS MANUFACTURE AND USE.

G. A. COWIE, M.A., B.Sc., A.I.C.

THE fixation of the nitrogen of the air and its conversion into a suitable chemical and mechanical form for application to the land constituted for a long time attractive problems for the chemist and the engineer alike. The actual discovery of a practical system of tapping this inexhaustible reservoir of gaseous nitrogen was, therefore, of unique importance, affording a valuable protection against a shortage of combined nitrogen for fertiliser and other purposes. In order to realise adequately the extent of this source of nitrogen it is interesting to recall that the atmosphere consists approximately of 21 per cent. of oxygen and 79 per cent. of nitrogen by volume.

In experiments described by himself in 1785, Cavendish caused the nitrogen and oxygen constituents of the air to combine by the aid of electric sparks, and in the presence of water or caustic potash obtained nitric acid or potassium nitrate. For a long time these experiments remained merely interesting class-room demonstrations, and all attempts to utilise them on a practical scale proved abortive. Research and investigation, however, were greatly stimulated by the growing realisation of the importance of nitrogen in plant nutrition and the necessity for providing fresh supplies, so as to render possible a more intensive system of food production to meet the requirements of a constantly expanding population. In 1898 Sir William Crookes depicted in rather despondent terms the grave effects of a shortage of nitrogenous fertilisers on our food supplies. His remedy for a shortage of wheat supplies was the artificial production and application to the land of much larger amounts of nitrates. While all may not agree with the conclusions of this eminent authority, his warning doubtless proved an incentive to the search for a practical method of producing nitrates from the nitrogen of the air.

The first practical success was achieved by two Norwegians, viz., Professor Birkeland of the University of Christiania, and Dr. Samuel Eyde, an engineer of Christiania, who established the now famous works at Notodden below Lake Tinnsjö. Since 1905, when the first factory was established, this industry has undergone a steady development until it has now assumed a position of enormous size and importance in Norway. During the late War there was a very considerable extension of the

industry with a view to the maximum production of various nitrogenous compounds. The output is now mainly available for fertilising purposes, principally in the form of nitrate of lime.

The process involved in the production of nitrates from the nitrogen of the air consists in passing air through an arc flame (at a temperature of about 3,200 °C.) produced between electrodes in a powerful magnetic field. The resulting nitric oxide gas is then cooled by suitable means and passed through so-called oxidation chambers, where it is given time for complete oxidation to nitrogen peroxide. Subsequently the nitrogen peroxide gas is passed up absorption towers, where it meets a descending stream of water and is converted into nitric acid. For fertilising purposes the nitric acid is then neutralised with limestone, and the product, after solidification and granulation, is sold as a manure under the name of nitrate of lime.

The commercial success of the process is dependent on the availability of cheap electric power, which, in Norway, is ensured by the numerous natural gigantic waterfalls. Full advantage has been taken of these natural resources and the huge total of 300,000 to 350,000 h.p. has now been successfully harnessed. The development of the industry in recent years has been phenomenal. In addition to some minor works there are two huge factories, one at Notodden and the other at Rjukan. The present capacity of the combined works is understood to be equal to an annual output of 186,000 tons of nitrate of lime or its equivalent per annum.

The Properties of Nitrate of Lime.—Nitrate of lime contains 13 per cent. of nitrogen, which is equivalent to 15·8 per cent. of ammonia. This nitrogen is also in the form in which plants take up their nitrogen under natural conditions, and it does not require, therefore, to undergo any change in the soil before it becomes available to the crop. In this respect it differs from sulphate of ammonia and still more from calcium cyanamide, the nitrogen in which must be transformed into nitrate in the soil before it can be absorbed by plants. In its general nature and use, therefore, nitrate of lime is closely allied to nitrate of soda.

A further important feature of nitrate of lime from the fertilising point of view is that the nitrate is combined with lime. While a part of this lime may be used for the nutriment of the crop, probably the greater proportion is left behind as carbonate of lime to improve or keep correct the physical and the chemical condition of the soil.

Nitrate of lime, as now manufactured, is of a dark grey colour and is very soluble in water. It is also hygroscopic, that is, it has the property of absorbing moisture from the atmosphere.

Nitrate of lime is now produced in a granular, dust-free condition, well adapted for sowing, either by hand or machine, without any previous crushing or treatment. Formerly, it contained a certain amount of dust which rendered the distribution, especially by hand, a more or less unpleasant operation, but this objection has been removed.

The Fertilising Value of Nitrate of Lime.—The manurial value of nitrate of lime has been adequately confirmed by the results of accurate field tests and practical evidence generally. It has proved practically equal in effectiveness to nitrate of soda on normal soils, while on soils poor in lime it has shown a distinct superiority. It has also the advantage that it does not injure the tilth of heavy soils, but will actually improve their physical condition by reason of the lime supplied. The rapid action of nitrate of lime also renders it a very effective manure when it is desired to give a crop a good start. Owing to its extreme solubility, it reaches the roots almost immediately, and its nitrogen is made directly available to the crop. Even during a drought the air moisture will gradually but completely dissolve the nitrate of lime, which will then find its way down through the soil. It therefore deserves attention as a top-dressing in districts subject to late spring and early summer droughts.

It might, of course, be reasonably argued that the ready solubility of nitrate of lime would render it liable to a certain amount of loss by leaching from the soil. The results of the comparative field trials with nitrogenous fertilisers, however, tend to disprove this idea. As a matter of fact, nitrate fertilisers are not so easily washed out of average soils as is popularly supposed, and when, as is most general, they are used as top-dressings, the risk of loss is reduced to a minimum.

The Application of Nitrate of Lime.—The production of nitrate of lime in a suitable granular form, free from dust, has removed practically all the difficulties previously associated with its distribution. It is important, however, that the material should be applied on a thoroughly dry day. If this is done, it can be handled as conveniently as can any other fertiliser.

It is also a point of practical importance that the granules should be just sufficiently small to ensure an even and efficient distribution without any previous crushing or treatment. In fact, when applied under dry weather conditions, nitrate

of lime should run very much like corn in the distributor and should fall from the hands in a more or less similar way.

Owing to its hygroscopic nature nitrate of lime is delivered in casks. The casks should not be opened until the material is required for immediate distribution under suitable dry weather conditions. It is also advisable, if the sowing is to be done by hand, to turn the sleeves well up. This avoids any unpleasantness occasioned by rubbing the skin with clothes which may have become a little damp with dissolved nitrate.

Mixing with other Manures.—Nitrate of lime, unfortunately, cannot be used in the manufacture of special or compound manures, on account of its property of absorbing moisture from the air. On the farm, however, it can be satisfactorily mixed with either superphosphate (if dry) or basic slag and, if necessary, potash salts, but in that case the mixing and that application of the mixtures should be carried out, if possible, on the same dry day.

Time of Application.—Nitrate of lime should generally be applied as a top-dressing. For root crops and potatoes, however, a proportion at least may advantageously be applied with the phosphates and potash immediately before sowing, the remainder being used as a top-dressing when the plants are above ground or after singling.

Autumn-sown Cereals.—For winter wheat and winter oats nitrate of lime should be applied about the end of March or just after the spring growth has well started.

Average dressing per acre—1½ to 2 cwt.

Spring-sown Cereals.—Nitrate of lime for these crops may be applied as a top-dressing when the crop is an inch or two above ground.

Average dressing per acre—1 to 1½ cwt.

Potatoes and Turnips.—For these crops perhaps the most convenient and effective plan is to mix the nitrate of lime with the phosphates and potash and distribute the mixture along the drills, or broadcast immediately before sowing. If preferred, the nitrate of lime can be applied in whole or in part as a top-dressing.

Average dressing per acre—1½ to 2 cwt. for potatoes, and 1 to 1½ cwt. for turnips.

Mangolds.—For this crop it is advisable to mix about one-third of the nitrate of lime with the phosphates and potash

and distribute the mixture immediately before sowing. The remaining two-thirds can be advantageously applied as a top-dressing after singling.

If preferred, the whole may be used as a top-dressing in one or two applications after singling.

Average dressing per acre—2 to 3 cwt.

Hay.—The end of March is sufficiently early for the applications of nitrate of lime to grass land.

Average dressing per acre—1½ to 2 cwt.

Results of Field Trials.—The results of official field trials in which nitrate of lime has been compared under equal conditions with the other nitrogenous fertilisers are set out below:—

OATS (1910-1912).

Cockle Park Experimental Farm. Clay Loam.

Manure.	Average of 3 Trials. *Grain per Acre.* Bush.	*Straw per Acre.* Cwt.
No Nitrogen	40·1	22·8
Nitrate of Soda	46·5	27·0
Sulphate of Ammonia	45·3	28·8
Nitrolim	42·3	26·1
Nitrate of Lime	45·6	28·3

BARLEY (1909).

Rothamsted Experimental Station. Heavy Loam.

Manure.	*Grain per Acre.* Bush.	*Straw per Acre.* Cwt.
Superphosphate	28·7	23·4
,, plus Nitrate of Soda	48·1	34·6
,, ,, Sulphate of Ammonia	49·0	31·4
,, ,, Nitrolim	45·2	35·5
,, ,, Nitrate of Lime	46·1	39·7

OATS AND BARLEY (1905–8).

North of Scotland College of Agriculture, Aberdeen. Soils various and generally lacking in Lime.

Manure.	Average of 10 Oat and 3 Barley Trials. *Grain per Acre.* Lb.	*Straw per Acre.* Cwt.
No Manure	2,196	27¾
Superphosphate and Potash	2,260	29
,, plus Nitrate of Soda	2,595	35¼
,, ,, Sulphate of Ammonia	2,668	35⅛
,, ,, Nitrolim	2,847	49¼
,, ,, Nitrate of Lime	3,128	53¼

MANGOLDS (1907–9).

University College, Reading. Strong Loam.

Manure.	Average of three years' yield of Mangolds per Acre. *Tons.*	*cwt.*
No Nitrogen	28	3½
Nitrate of Soda	34	18
Sulphate of Ammonia	33	1½
Nitrolim	33	3¼
Nitrate of Lime	35	1

SWEDES (1911).

Bangor College. Medium Loam.

Manure.	Yield of Roots per Acre. *Tons.*	*cwt.*	*lb.*
Phosphate and Potash	10	15	0
,, ,, plus Nitrate of Soda ..	12	0	0
,, ,, ,, Sulphate of Ammonia	12	12	0
,, ,, ,, Nitrolim	12	13	0
,, ,, ,, Nitrate of Lime ..	13	1	0

"SEEDS" HAY (1914).

Midland Agricultural College. Gravelly Loam.

Manure.	Yield of Hay per Acre from two crops. *Tons.*	*cwt.*	*qr.*
Phosphate and Potash	3	9	3
,, ,, plus Nitrate of Soda ..	4	0	0
,, ,, ,, Sulphate of Ammonia	3	18	2
,, ,, ,, Nitrolim	3	8	1
,, ,, ,, Nitrate of Lime ..	3	19	1

POTATOES.

Jersey Agricultural Instruction Committee. Soils Various.

Manure.	Average of 5 Trials. Yield of Potatoes per Acre. *Lb.*
Superphosphate and Potash	7,800
,, ,, plus Nitrate of Soda	8,840
,, ,, ,, Sulphate of Ammonia	9,120
,, ,, ,, Nitrolim ..	9,280
,, ,, ,, Nitrate of Lime	9,120

THE COMPOSITION OF POTATOES IMMUNE FROM WART DISEASE.

E. J. RUSSELL, D.Sc., F.R.S.,

Director of the Rothamsted Experimental Station.

HITHERTO the farmer has not concerned himself much with the feeding value of the foods grown on the farm for human consumption, and a complaisant public has asked for nothing more than a natural unadulterated product. Until 1917 no attempt was made in this country to investigate the value of different varieties of potatoes as human food. Actual feeding tests on human beings had, however, been made in America. Few chemical analyses of British potatoes had been made, apart from the dry matter and the nitrogen determinations of Lawes and Gilbert in 1887. Detailed chemical analyses of potatoes are by no means easy and would not necessarily be very helpful. Physiologists regard the dry matter content as an important criterion, and ordinary conventional analytical methods indicate nothing better. Judged from this standpoint the analytical results show that absolutely unimpeachable potatoes may vary considerably in their food values, the extreme limits in the ordinary varieties on the market ranging from 17·6 to 29·1 per cent. of dry matter. It is possible that some day a different method of purchasing will prevail, and that the dry matter of the crop may be taken into consideration in assessing its market value. This would be both logical and legitimate, and if ever such a method should come to be adopted it is gratifying to know that the new immune varieties will, so far as these analyses indicate, compare favourably with the old.

During 1918 the Food Production Department arranged for determinations to be made of the amount of dry matter in different commercial varieties of potatoes grown in 1917 under different conditions in England. The results of the investigations have been published in the Report on the Composition of Potatoes grown in the United Kingdom, issued by the Food (War) Committee of the Royal Society.* Since that work was completed the Glamorgan County Council have forwarded to the Rothamsted Experimental Station samples of 32 varieties of potatoes immune from wart disease, and these have been analysed in the Rothamsted laboratories

* Obtainable from Messrs. Harrison & Son, St. Martin's Lane, London, W.C. 2, price 2*s*. A note on the Report was published in this *Journal*, October, 1919, p. 741.

by A. H. Bowden, who used the same methods as were adopted by Misses M. D. Glynne and V. G. Jackson in 1918 ; the results are, therefore, strictly comparable. The summarised results are shown in the following table :—

—	1917 Crop : Non-immune Varieties.				1919 Crop : Immune Varieties, Glamorgan.
	Mean of all analyses.		Rothamsted analyses.		
	All results.	W. country only.*	All results.	W. country only.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Dry matter	22·09	21·99	22·41	21·22	23·93
Range of variation ..	17·60 to 29·08	—	18·33 to 26·33	18·69 to 24·76	22·11 to 27·32
Nitrogen in dry matter ..	1·48	—	1·38	1·40	1·65
Range of variation ..	—	—	·936 to 1·84	1·05 to 1·86	1·38 to 1·98
Nitrogen in fresh material	·327	·337	0·308	0·305	0·390
Range of variation ..	·204 to ·526	—	·204 to ·420	0·204 to 0·420	0·315 to 0·457
Weight of 1 tuber, Grams	—	—	139	133	152
Range of variation ,,	—	—	39·25 to 203·9	39·3 to 188	110 to 202

* The four common varieties.

It is impossible to make a strict comparison between the immune and the non-immune varieties, because they were not grown in the same season. The years 1917 and 1919 differed in character, and the effect of seasonal differences is well-known and marked. In particular 1919, during the growing period of the potato, was drier and less favourable to growth than 1917, which would tend to increase the dry matter of the tubers. A general comparison only is possible, and this indicates that the percentage of dry matter and of nitrogen in varieties immune from wart disease is at least as high as in ordinary non-immune varieties, and, therefore, the consuming public will suffer nothing by the substitution of these new varieties for the old ones.

The data are too few in number to allow of any detailed comparison between the different varieties of immune potatoes. It will be observed (Table on p. 51) that the sample of Leinster Wonder stands out well with 27·3 per cent. of dry matter, while the Improved Ashleaf had 22·1 per cent. only. The percentage of nitrogen varies in the different samples, being 0·457 in the sample of Witch Hill, but 0·315 only in Lochar. These figures are chiefly of value as showing the existence of the variations : it would need many more determinations before one could say with certainty whether one variety was distinctly better than another in dry matter or nitrogen content.

Composition of certain Samples of Immune Varieties of Potatoes grown in Glamorganshire, 1917.

Variety.	Dry Matter.	Nitrogen in dry Matter.	Nitrogen in fresh Tuber.	Average Weight of Tuber in Sample.
	Per cent.	Per cent.	Per cent.	Grams.
Duchess	24·63	1·628	·402	202·0
Rector	24·27	1·402	·340	201·6
Arran Victory ..	24·59	1·415	·348	146·8
Arran Rose ..	25·59	1·380	·353	167·5
Bishop	24·44	1·523	·372	158·3
White City	25·00	1·538	·385	191·4
Majestic	22·41	1·584	·355	176·8
Arran Comrade ..	24·31	1·610	·391	155·3
Ally	22·76	1·607	·366	165·8
Flour Ball	22·20	1·825	·405	129·2
Lochar	22·13	1·423	·315	163·5
Witch Hill	23·19	1·969	·457	131·7
Resistant Snowdrop	23·75	1·631	·387	153·7
Tinwalds' Perfection	24·35	1·657	·403	114·7
Leinster Wonder ..	27·32	1·643	·400	141·8
Kerr's New White..	26·58	1·564	·416	144·7
Dargill Early ..	21·98	1·984	·436	111·0
Provost	24·77	1·621	·401	114·8
Nithsdale	22·43	1·817	·407	202·3
Improved Ashleaf ..	22·11	1·884	·417	111·2
Burnhouse Beauty ..	24·56	1·851	·455	110·4
Kerr's Pink ..	22·92	1·632	·374	146·3
Average ..	23·92	1·65	·390	151·8

A WOMAN'S IMPRESSIONS OF A DANISH SMALL HOLDING.*

BERTHA M. BAYNE,

Late Chief Inspector, Women's Branch, Ministry of Agriculture and Fisheries.

ONE of the results of the War has been a national realisation of the importance of increased home food production, and an awakening to the need in rural England of a healthy, contented and prosperous population. The influence of women in helping to secure these desired ends is being more and more recognised, and this recognition found practical expression in the spring of last year in the appointment of a delegation of women from England and Wales by Lord Ernle (then President of the Board of Agriculture and Fisheries) to visit Denmark to study the conditions under which agriculture is carried out on the small farms in Denmark, and ascertain whether these conditions might serve as an object-lesson to prospective women small holders in this country.

Denmark is pre-eminently the home of small holders. The reason for this, very probably, may be traced to the disastrous war between Denmark and Germany in 1863–66. The Danish Government realised that if Denmark were to recover from the poverty and misery to which she had been brought through the war, salvation lay along the paths of agriculture, and, acting in the belief that agricultural production is the basis of a nation's prosperity and strength, steps were taken to parcel out the land in such a way as to bring within the reach of all who so desired the possibility of possessing their own land. To assist those desirous of settling on the land, extensive credit facilities were provided by the legislature, and co-operative methods of buying and selling were generally adopted. It is not too much to say that as a result of this wise action in the encouragement of ownership Denmark was raised from bankruptcy to prosperity, and the land was peopled with a happy and prosperous population.

The population of Denmark is now about 2,600,000, and it is instructive to note that about half the people live entirely on the land, a great proportion of the remainder being engaged in work indirectly connected with it.

* This Report was prepared by Mrs. Bayne as a result of a visit to Denmark in 1919, as one of a delegation of women who desired to study at first hand Danish conditions in relation to women's work on the land.

Of the 250,000 landed properties in Denmark, 46,600 comprise only from 12 to 35 acres, and 133,600 less than 12 acres. An interesting but surprising fact is the statement made to the delegates that practically none of these farms or small holdings was farmed or managed by women, although all the facilities granted by the Danish Government to the people have been from the beginning offered on equal terms to women as well as to men. The only cases of women small holders were found to be those where the widows of small holders had carried on the farm after the death of the husband. In reply to inquiries on this matter, the answer was that there were sufficient men in Denmark to do the farming without the aid of women, and the impression made was that at the present time the conditions and prejudices prevailing with regard to women farmers were very much the same as those which existed in this country at the commencement of the War. It is difficult to understand why this should have been so, as to work a small holding on Danish lines presented nothing that two *skilled* women (exclusive of any housework) could not advantageously undertake, without having recourse to paid labour, except at busy times.

The farms visited by the delegates were situated in the neighbourhood of Ringsted, Odense and Copenhagen, and a few of the members of the party had the opportunity of inspecting also some of the small holdings in Jutland.

The areas of these farms varied from 3 to 80 acres (the latter area constituting a large farm in Denmark), but the most usual size of those selected for inspection was from 8 to 12 acres, except in the case of Jutland, where the land was so poor that at least 30 acres are necessary in order to make a living.

The life and conditions of work of the small holder generally can, perhaps, be best understood by taking from amongst the farms visited a representative holding of 12 acres, typical of the others of a similar nature. This small holding was one of about 17 others in the district of Ringsted, and as the owner had been in America for a considerable time, it was possible to converse with him more freely and satisfactorily than could be done where one was dependent for intercourse upon the services of an interpreter. As already stated, the holding consisted of 12 acres (8½ Danish tondeland). The owner told us that he had been in occupation of it for 13 years, and that the price of the land and the cost of buildings and equipment at entry was 22,000 kroners (about £1,237*), towards which he

* Figures represent normal rate of exchange.

had contributed 13,000 kroners (about £730) at the time of purchase. It may be stated, however, that it is only necessary for a prospective holder in Denmark to provide one-tenth of the capital required for the purchase of land, buildings and equipment; the remainder will be supplied by the Danish Government at 3½ per cent. interest per annum.

The soil of this holding was fairly light, being a medium quality loam, which, the owner said, was more or less workable at all times. His system of cropping was an eight-course one, the crops grown being rye, sugar beet, oats, lucerne, barley with seeds, mangolds, peas mixed with oats or barley, and potatoes.

As to the house and buildings, these were excellent for the purpose, as were all those we saw on the other holdings. They were built in the form of a quadrangle, and in the centre was a pump, from which the water supply was obtained. All the animals had their separate quarters under one roof, the pigs being always under cover. From the animals' quarters a drain was run to conduct all the liquid manure to a tank fitted with a pump. Farmyard manure is the main fertiliser which the holder looks to for his crops, and no portion of it is ever wasted.

The house, of bungalow type, was very nice and convenient, comfortably and well furnished. It contained a kitchen, 2 sitting rooms and 2 bedrooms, and situated over all was a large loft which could be used for storing purposes, and might, if needed, be partitioned off at one end to provide an extra bedroom.

The family consisted only of the owner, his wife, and a girl of about 10 years old, so that the small holder had to do practically the whole work of the holding himself, his wife and child assisting with the lighter work, and only at busy times. He told us that it was expensive to hire occasional labour, as the payment for a man amounted to 10 kroners a day; but that the small holders arranged between themselves that one should help the other when in need, and that this arrangement worked very well.

The live stock consisted, at the time of our visit, of 3 cows in milk (a fourth was shortly to be procured, the normal number kept on the farm being 4), 2 heifers and a bull, 2 horses, 2 pigs, and 50 head of poultry. In pre-war days, when supplies of feeding stuffs were so much more abundant, about 10 pigs were kept.

The main system of Danish agriculture is an intensive husbandry, based upon the keeping of animals and the cultivation of forage crops. There is practically no pasture on any

of the small holdings, and animals are generally tethered. We even saw this practice carried so far as to include a hen! The method of tethering prevents any waste of forage through its being trampled upon by the animals. A certain amount of extra labour, however, is entailed, as the stakes have to be moved about six times a day. It may be remarked that in the height of summer the animals appeared to be somewhat unduly exposed to the heat of the sun, and to be troubled by flies.

A co-operative dairy, bacon factory and egg-collecting depot were within easy reach of the small holdings, and practically all produce was sold there. The milk is collected by the dairy and is paid for on the basis of the amount of butter fat it contains, the skim milk being returned to the small holder for feeding purposes. The average yield of milk per cow (generally Red Danish) is from 700 to 800 gallons per annum. The pigs are taken to the bacon factory and the farmer is paid on delivery at the current market price. In addition he receives later his share of the profits based on the co-operative system, as being a member of the factory. The small holder told us that he could, in normal times, produce a pig weighing 164 lb. at 6 months old. The eggs are paid for by weight, their price being 2 kroners or about 2*s*. 2*d*. per lb. (8 eggs).

In reply to what were, perhaps, somewhat searching inquiries, yet answered in the most friendly and frank manner, the small holder said that he was very well satisfied with the life and the financial returns from the holding, although after he had provided for his family and met the working expenses of his farm, the returns were not large. (In this connection it may be of interest to mention that at a later interview with the Secretary of the Danish Small Holders' Association—himself a small holder of 17 years standing—he informed us that it was possible for a small holder on 12–15 acres to save about £50 per annum, although many of them could not save so much.) As to the strenuous nature of the life, the owner said that on the whole it was not unduly strenuous, and that he had plenty of leisure time for himself, that there were many national holidays in Denmark, and that most of the small holders were able to avail themselves of them as they came round. He expressed his position by the remark, " The place is my own, I am working for myself and I can do much or little, entirely as it suits me." He told us that he rose very early, but took a considerable time off in the middle of the day.

From the above description, which, as stated, may be taken as typical of all the small farms which we saw, it may be said that

the bulk of them are successful and that their success depends upon :—

1. Business-like co-operative methods for all buying and selling.
2. Suitable soil.
3. Convenient and good house and buildings.
4. Adequate credit facilities.

Co-operation is placed first among the causes of success, as a clear understanding of its principles by the Danish nation as a whole has enabled the country to build up on this foundation a strong and prosperous agricultural industry. This co-operative spirit is undoubtedly fostered by the small holders' schools and by the excellent rural high schools,* which are a speciality of Danish rural life.

Attention was principally directed, as is shown in this article, to the small farms, as the object of the mission was mainly to examine Danish conditions in their relation to the interests of women. It was felt that there are a great number of women in England and Wales of average ability and physical strength, with very small or no capital or income, who would welcome the opportunity of living usefully, independently and profitably in the country, and to whom the conditions of the Danish system of farming could be applied, if an adaptation to suit conditions as set forth above could be made in this country.

* See the issue of this *Journal* for last month, p. 1063.

FRENCH AGRICULTURAL SOIL MAPS.

Lieut.-Colonel LOUIS TEBBUTT has forwarded to the Ministry a sample of agricultural maps drawn up by the Agricultural Experiment Station of the Department of the Somme. The maps are placed in the Communal Town Room for inspection by all interested. The map is reproduced here to show their general character. It is really a large-scale geological map such as can be obtained from the Geological Survey of this country, but it contains in addition information as to soils derived from actual analysis.

The drawing up of these maps has long been carried out in France, the work being particularly associated with the Station Agronomique de l'Aisne at Laon. Ever since 1856 M. Risler, then Director of the Institut Agronomique, has drawn attention to the close relationship between geological origin and soil type, which in France has subsequently been strongly emphasised; writers have even claimed that soils derived from the same geological stratum have the same composition.

The colours on the map show the geological formation (Couches Geologiques). The little columns in the numbered oblongs show the chemical composition of the soil, the yellow column on the right-hand side giving the percentage of total lime (not carbonate, as would be given here*; the three left-hand columns show the number of parts per thousand (*i.e.*, percentages multiplied by 10) of nitrogen (slate coloured), phosphoric acid and potash. The circles with coloured sectors show the mechanical composition, the soil being sub-divided into humus, chalk, sand and clay: these terms possess a definite meaning well understood by French agricultural experts, though they do not correspond exactly with the same terms as used in this country. Thus the "humus" nearly corresponds with our "Organic Matter," but is quite different from our "Soluble Humus"; the "chalk" is our "Carbonates reckoned as calcium carbonate"; the "sand" is our "Coarse Sand" and some "Fine Sand," while the "clay" is our "Clay," "fine silt," "silt," and some "fine sand."

The map is certainly very interesting and could be used effectively in discussing local experience with lime, fertilisers, etc., and the results of agricultural and horticultural trials. A village schoolmaster who was also a keen gardener could, with his local knowledge, make considerable use of it.

* Where the yellow column in the diagrams on the map is broken in the top division, the percentage of lime is higher than can be shown in the columns.

Some progress has been made in the provision of similar maps in this country, and analyses of soils which would furnish additional useful data are steadily accumulating at various centres. The problem is usually more intricate in this country than in France. The foundation of this map is the assumption that the soil arises from the formation shown on the geological map. This is not true of drift soils. France is less troubled by drift soils than we are, for over much of the Northern part of England the soil is entirely drift, and in some cases very complex drift which is not always closely subdivided on the map. There is no doubt, however, that many maps on this pattern might be made in this country, utilising material and knowledge already easily obtainable.

Lieut.-Colonel Louis Tebbutt writes as follows :—

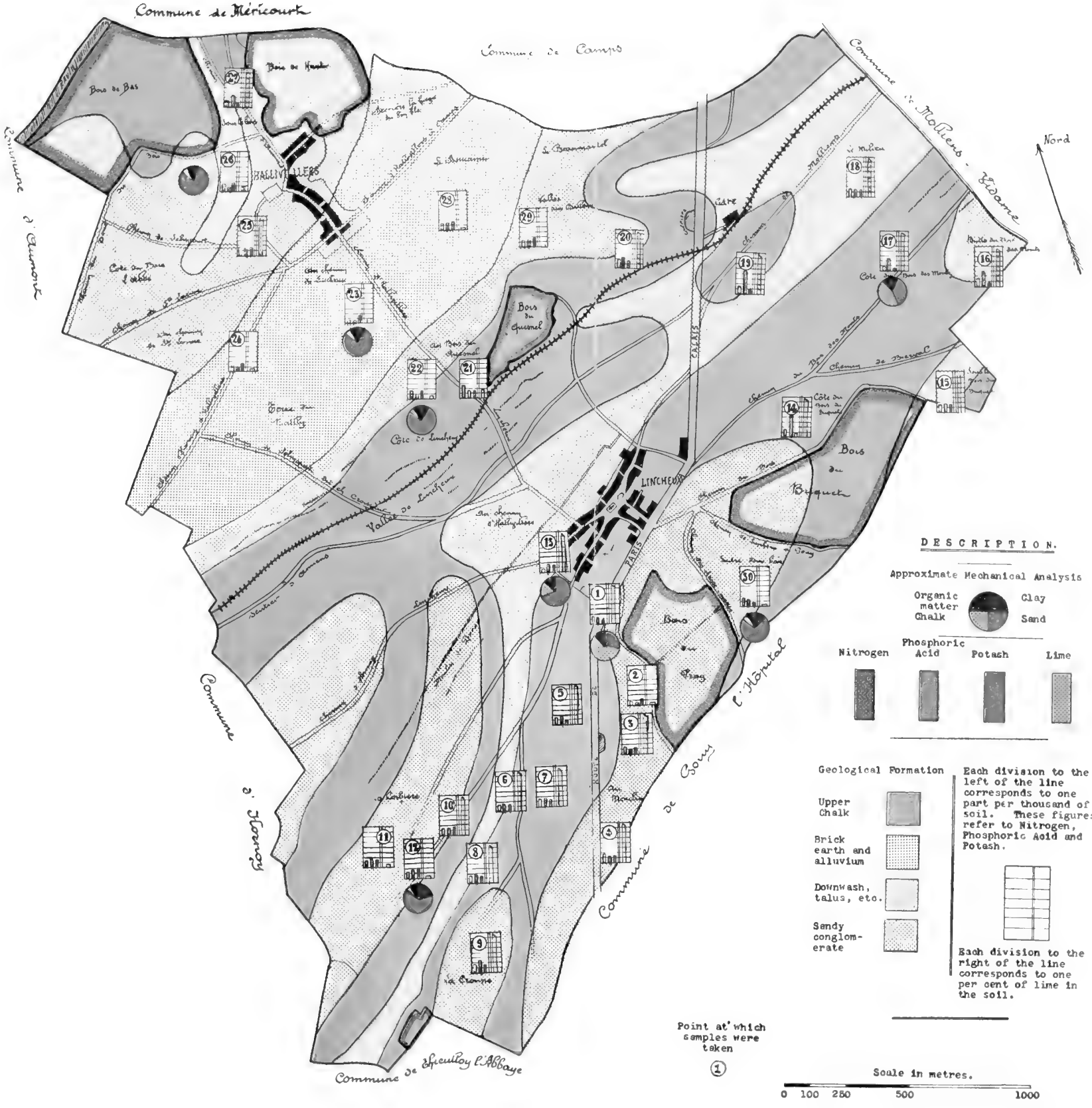
"In the course of my duties in France as an Officer of the British Army, I visited a number of villages or 'communes.' The commune is a more organised and independent unit of government than an English parish, and possesses a town room or miniature town hall, which is usually attached to the elementary school.

"In one of these schools I saw a map which was covered with tracing paper to protect it from dust, light, etc. Under the tracing paper the map appeared quite different from any to be seen in England, but it resembled a geological map.

"The Secretary of the commune, who is also the local schoolmaster, explained that it was an agricultural map of the parish. He could not say more, however, as he had only lately come into the parish, but I was informed that this map had been made at the 'Station Agronomique,' which is or was at the chief town of the Department.

"I therefore visited the 'Station Agronomique,' where I made the acquaintance of the Chief or Director, who had made this map and other similar ones. The 'Station Agronomique' is a semi-state laboratory, and the Director is a person who has made a special study of geology, agriculture, chemistry, surveying and foodstuffs. His qualifications are similar to those of an English public analyst, but he possesses a special knowledge of the scientific side of agriculture.

"A large library of books, pamphlets and magazines was attached to his office, besides his laboratory, and in the course of his duties he analysed soils, milk, manure, etc., and gave advice. He said that he could not advise the agriculturist on practical farming questions, but he could assist him on the scientific side of his business.


Commune de Méricourt
Commune de Camps
Commune de Molliens - Vidame
Commune d'Elincourt
Commune d'Hornoy
Commune de Sourdon
Commune de Thieulloy l'Abbaye
Nord
HALLIVILLERS
LINCHEUX
Bois du Quesnel
Bois du Buquet
Côte de Lincheux
Vallée de Lincheux
Bois de Bas
Bois de Haut
Côte du Bois du Buquet
Côte du Bois des Monts
Terres de Hallivillers
Bois
PARIS
CALAIS
DESCRIPTION.
Approximate Mechanical Analysis
Organic matter
Chalk
Clay
Sand
Nitrogen
Phosphoric Acid
Potash
Lime
Geological Formation
Upper Chalk
Brick earth and alluvium
Downwash, talus, etc.
Sandy conglomerate
Each division to the left of the line corresponds to one part per thousand of soil. These figures refer to Nitrogen, Phosphoric Acid and Potash.
Each division to the right of the line corresponds to one per cent of lime in the soil.
Point at which samples were taken
1
Scale in metres.
0 100 250 500 1000

"With the geniality and intelligence of a French professional gentleman, he explained how these maps were made, and was willing to copy one with the preliminary sketched plans.

"His laboratory staff was then reduced in number, and he was at work helping in the devastated areas of the North of France, but with considerable trouble he had the map (reproduced here) copied.

"The genesis of the maps is in the Communal Council, when it decides to ask the General Council of the Department (a similar body to the English County Council) for a grant to arrange a survey. The General Council will grant a part of the cost on condition that a copy of the survey is sent to them, and I think the State also is asked to contribute. When the decision to draw up a map is made, the Chief or the Director of the Station visits the parish, and prepares a copy of the cadestral map of the area to be surveyed.

"After correcting the cadestral map the Director next obtains the geological map made by the State and corrects it by going over the parish himself and making a geological drift survey. The next stage is to draw samples of soil of each part, taking great care properly to arrange the samples. Each sample is put in a special bag, numbered and marked, indicating the place from which it was drawn. These samples are taken to the Director's laboratory and are analysed chemically and physically.

"In the map copied, 30 samples were made. All were analysed for chemical composition and eight were analysed physically. On each place from which a sample was taken a small diagram is drawn, showing the percentage of nitrogen, phosphoric acid, potash and lime. The eight physical analyses are shown also on the map,* as well as diagrammatically. The name of the Station and the kind of soil are shown by colours and letters.

"With the map a monograph is prepared, giving information as to the history of the agriculture of the parish—the areas devoted to the various crops, and census of animals. The monograph is a small book of 11 pages.

"The next and last stage is a meeting of the agriculturists of the parish, in order that the Director may explain the map and the various uses to which it may be put, as well as the relative values of the manures applicable to the soils in the parish. The kinds of wheat and corn used may also be discussed.

* Nos. 1, 12, 13, 17, 22, 23, 26, and 30.

"The agricultural survey in respect of this map was made in 1911, by Monsieur L. Crochetelle, Director de la State de la Somme, Amiens.

"The bridging of the gap between science and practice is one of the great needs of British industry and commerce, especially with regard to agriculture, and the employment of these agricultural maps should help in this direction. Science combined with practical knowledge is the surest road to financial success. As regards the expenses of this survey, the whole cost was less than £50, and this would probably be more than repaid by results in the first year."

Wild White Clover: Its Value in the Formation of Pastures.

WILD white clover is indigenous on grass lands throughout the country, being found both on the best fattening pastures and frequently on quite poor types of grass land. If present on a field even in minute quantities it responds freely to basic slag and rapidly increases in amount under the influence of this manure.

The great value of wild white clover in the formation of pastures is due largely to the rapidity with which it forms a sward, and thus keeps out weeds; and to its beneficial effect on the grasses associated with it and on the fertility of the land for subsequent arable crops when the turf is broken and the residues are ploughed down. Seed of wild white clover should be included in all mixtures for leys of three or more years' duration; it hastens the development of a close sole, encourages rough-stalked meadow grass—a nutritious plant which remains green throughout the winter—keeps out weeds, and makes for fertility.

Some striking results of experiments comparing ordinary white Dutch clover with wild white clover are reported from the North Wales University College. Trials with seed mixtures were carried out at five centres, and 2 lb. of wild white clover in the mixture was compared with 2 lb. of ordinary white Dutch clover. The proportion of ground occupied $2\frac{1}{2}$ years after sowing was 23 per cent. of wild white clover, or ten times as much ground as was covered by the ordinary clover. In fact it was probable that the plants from ordinary seed had all died out after $2\frac{1}{2}$ years, and the plants occurring were the product of seeds present naturally in the soil before seeding. The difference resulting from using wild white clover was still

quite marked even after 5 years. Where the land has been ploughed up a much heavier crop of oats has almost invariably resulted from the wild white clover.

At present prices of 30*s*. to 35*s*. a lb. it may not be economical to sow as much as 2 lb. per acre, but ½ lb. per acre of wild white clover seed adds greatly to the value of a seed mixture and should, as a rule, be included for both temporary leys and permanent pastures. With proper treatment the rooting thus obtained will be sufficient to provide an ample covering.

It is highly desirable that more farmers should arrange to harvest seed supplies of this valuable plant. For immediate requirements, fields which are naturally full of white clover should be selected. The crop should not be cut until it is ripe. In most cases the ordinary hay mowing machine, with the knives set as low as possible, will be found quite satisfactory, but when the crop is very short it may be necessary to cut with the scythe.

Information as to handling the crop after cutting will be found in a bulletin issued by the Ministry on Growing Wild White Clover for Seed. Threshed and roughly dressed by such means as are at the disposal of the farmer, the seed may be used for his own purposes. Any surplus could readily be disposed of to seed merchants who have special machinery for cleaning and dressing before the seed is offered for general sale.

Where it is desired to establish white clover meadows for seeding purposes, old pastures with little grass (but with a sprinkling of white clover) are usually selected. They should be dressed with about 7 to 10 cwt. per acre of basic slag in the autumn or early winter and should be grazed with cattle till the end of May in order to keep down the grass. The clover should then be fit for harvesting in August or September.

THE ESTABLISHMENT OF VILLAGE INDUSTRIES.

SIR JOHN L. GREEN,
Director of Rural Industries.

IN considering the matter of village industries County Councils should have regard to the question whether the results of any action on their part will directly or indirectly improve the conditions of the agricultural industry and of those dependent upon it.

It is highly undesirable to draw away those now engaged in purely agricultural work, bringing in due economic reward, in order that they may engage in other forms of work not so directly connected or, perhaps, not even connected at all, with agriculture. The real object should be to seek to improve the conditions affecting the agricultural industry, and any avenue leading directly or indirectly to that should at least be explored.

Within these limits there can, in the writer's opinion, be no doubt that there is a wide field for useful effort on the part of County Councils, though the effective and permanent results of such effort will naturally be more pronounced in some counties than in others.

County Councils should first ascertain what is reasonably possible or practicable, for instance, what rural industries—apart from agriculture itself—really exist in the various parishes, what their condition is, and whether they are capable of improvement, and, if so, to what extent and in what way can that improvement be brought about? They should further inquire what other industries can be started, and the extent to which they can be fostered, and by what methods.

It will probably be found that local conditions will in many cases determine what it is possible to achieve. For example, where osiers are available, where forestry is encouraged, or where an "underwood" industry exists, there should be room for the improved or increased production of baskets (both of the fancy and utilitarian types), hurdles, spars, wooden toys, etc. These represent industries which would appear to offer great scope for development, since, in the main, they can be performed when purely agricultural operations are slackest.

There is no very great skill required in making baskets, and these could be made under healthier conditions in the country or country town than in a populous urban centre, while the

actual sales of country-made baskets could, it is asserted, be as well and as economically transacted as under existing conditions in the towns.

Further, inquiry has shown that here and there throughout the rural districts, and especially in the smaller market towns, there are usually one or two basket-makers who, not altogether through their own fault, live a more or less precarious existence, but who, if they and their industry were taken in hand, could be helped with advantage both to agriculture and to the general public. At present these workers appear usually to make one or two kinds of baskets which they sell generally to the farmers and other villagers of their respective districts, either by calling upon them for the purpose or by exposing their wares for sale in the market place or in a shop in the market town.

The industry and, therefore, the livelihood of the basket-makers is precarious; but the reason for this unsatisfactory state of things is largely that the men themselves show a lack of enterprise in making only a very small range of goods, while their usual method of selling is wasteful in the extreme.

The best remedy is the production and co-operative disposal of a larger range of marketable commodities. As regards production, the education of the basket-makers is of importance, for if a greater range of baskets is to be produced the makers must be provided with the necessary tuition. It should not be difficult to give this to men who already have skill. Further, the co-operative movement should include not only the disposal of goods but also the continuous supply of fresh designs.

Another medium for the encouragement of village industries has been the Women's Institutes movement, the progress of which during the past five years has been phenomenal. The potentialities of that movement are far from being fully appreciated.

During the early years of the War women in many English counties started the making of all sorts of stuffed toys, fancy leather goods, and other small articles. The work was closed down at the end of 1917, owing to the desire of the Government to employ the people engaged in it in more useful occupations directly bearing on the conduct of the War. By that time, however, it had been proved that our country people possessed the necessary talent to produce goods equal in quality to the competing imported articles, if only they were given the opportunity to display their ability. That opportunity had been given; the goods the villagers produced were readily

sold in 200 to 300 retail shops from Newcastle-on-Tyne to Plymouth, and also exported (*e.g.*, to America and Denmark), money going regularly into the pockets of a considerable number of country workers.

Under good business management, the Women's Institutes are eminently fitted to revive and carry on this work. It must be remembered that the occupations are such as do not necessarily demand constant application, and that, therefore, they appeal very strongly to the mothers and daughters who can often employ an odd hour or two daily, or a few hours weekly, on such occupations, with pleasure and profit to themselves, but who could not give regularly so much as three, four, five or more hours a day.

When considering the utility of "domestic industries" it should also be remembered that if pleasurable and profitable home work can be given to the grown-up daughters of a family there is less likelihood of the girls leaving home for the urban centres.

This work, too, appeals not only to the cottage women and to their daughters but also to a considerable number of women of education and reduced incomes, whose education should be of great value in a movement of this sort, and who are, in fact, its natural leaders wherever they can be found. There is every reason why educated women should join forces with the cottage women, under careful and energetic management, and to make rural employment of economic advantage to themselves and to the nation.

If these and other rural domestic industries are to be as successful as they might be, and ought to be, it is necessary that County Councils should provide instruction in them. It is also necessary that, in addition to instruction, provision should be made for supplying a succession of the most attractive designs to learners and workers so that the public may constantly see new articles coming on the market.

If these two matters receive attention, and if, also, raw materials are purchased, and the goods made from them are sold under a system of co-operation or some other organised method, success should be assured.

PRESERVING GREEN FODDER:

AN INEXPENSIVE TRENCH SILO.

A. W. OLDERSHAW, M.B.E., B.Sc.,

County Agricultural Organiser for East Suffolk.

ENSILAGE is at the present time receiving much attention from farmers in all parts of the country, partly no doubt owing to the introduction of cylindrical stave and concrete silos of the American pattern. Unfortunately, however, the process has been heavily handicapped during the past three years by the high cost of these structures. Mr. Arthur Amos, M.A.,* recently estimated the cost of a cylindrical silo capable of holding 150 tons of silage at £400. Where suitable materials for making concrete exist on the farm the cost of erecting a silo might conceivably be less, but in any case it is bound to be high. The large initial outlay involved will cause even large farmers to hesitate, while to small farmers the cost will be prohibitive. The writer has given a brief account of these cylindrical silos elsewhere.†

In these circumstances any alternative method of making silage is worth considering, even although the method may be less perfect, and may involve rather greater loss of material than would the cylindrical silo.

The writer has elsewhere‡ referred to a method of making silage which has been practised by Mr. Wm. Makens, of Colney, Norwich, for a number of years. The method was described in some detail in the issue of this *Journal* for July, 1919, and photographs were given showing the "trench" when full of silage, and also the operation of covering with earth. The trenches used by Mr. Makens vary in size; the largest is 4 ft. deep, 25 yd. long, and about 5 yd. wide. This trench is filled with green material and afterwards covered with earth. In the year 1919, owing to drought, the quantity of green material available to fill Mr. Makens' trenches was very small. The material used was rye and tares mixed, and for some reason the tares made a comparatively small growth, with the result that the green stuff consisted largely of rye. The quality of the silage, however, proved satisfactory.

* Paper read before the Farmers' Club, 1st March, 1920.

† Transactions of the Highland and Agricultural Society of Scotland, 1917, and this *Journal*, February, 1917, p. 1063.

‡ Journal of the Bath and West and Southern Counties Society, 1918–19, and this *Journal*, July, 1919, p. 450.

The writer had an opportunity of gaining further experience of this method of making silage, when visiting his father's farm in Nottinghamshire during the summer of 1919. A field of second-crop clover and rye-grass, consisting chiefly of clover, was available. The weather had for some time been very showery, the dews in the morning were very heavy, and considerable difficulty was anticipated in making the crop into satisfactory hay, especially as it was very succulent. It was, therefore, decided to make it into silage. In Mr. Makens' case the land is very light, and all drainage from the silage, with any rain water, easily passes into the subsoil, from the bottom of the pit. In this case, however, the land is heavy, and at the most convenient site where the silage could be made no simple method existed whereby underground water which might accumulate at the bottom of a deep pit could be drained away by pipes or other means. There was, further, no deep ditch near. It was, therefore, decided not to excavate so deep a pit as was used by Mr. Makens. The site chosen, a piece of ground about 10 yd. long by 3½ yd. wide, was ploughed over, and the soil then thrown on to the side by hand. This process was repeated in the case of the subsoil and was continued until a depth of about 2 ft. 6 in. below the surface was reached, when the floor was levelled by hand.

The subsoil at this depth was rather unexpectedly found to be much lighter and more pervious than the surface soil, and might be described as a loam rather than a clay. This possibly explains why no trouble was experienced from standing water accumulating in the pit, as might have been expected from the texture of the surface soil.

As soon as the pit was excavated a portion of the crop was cut, and men and women were engaged in carting home the crop. The operation is very similar in every way to the carting home of mangolds. A boy was employed on the carts, and three women and one man performed the work of filling them. On reaching home the carts were merely tipped into the trench, and the long green clover was roughly levelled. To compress the material the full and empty carts were drawn over the mass in the trench, and as the work p ogressed a horse was employed to walk about on the green mass in order to consolidate it. In most cases it was found possible to send the carts back empty within five minutes of their arrival full of clover at the trench. All the work of emptying the carts and levelling the green material was performed by one man until about the last day of filling. The work was continued for four working days in

Removing Clover and Rye-grass Silage from a "trench" silo on Mr. John Oldershaw's farm.

all, but the days were not consecutive. The work commenced on a Monday, was continued on Tuesday and was then resumed on Friday and again on the following Monday. This gave time for the mass to settle somewhat before the final filling. A seven-acre crop of clover was put into the trench, and the heap was then topped up as well as possible with green clover and finally with rough stuff from hedge bottoms. Afterwards, as soon as the operation could be carried out, it was covered with earth, when it resembled a mangold pit. It may be mentioned that the heap was made as high as it conveniently could be by carting full loads up the ends, being subsequently topped up by hand.

The material was put in on the day of cutting, and owing to heavy dews was often very moist in the early part of the day. This pit was opened about Christmas, and a sample was taken for analysis. It was found that the rainwater had penetrated to a depth of two or three inches, causing the material to rot to that depth, while a certain amount of the silage on the sides and ends had also become rotten. Apart from this the bulk of the silage proved of excellent quality, and was relished by the stock, which left good hay to eat it as soon as they became accustomed to it. Being in its long state it was cut out in sections exactly as is done with hay, and carted to the stock. It was used regularly during January and February, being fed mainly to milk cows and store cattle. The quantity fed was one cart-load a day, and the heap lasted for 69 days.

It is very difficult to estimate the proportion of waste on the sides and top of the heap; in fact this could only be done by weighing every cart-load of good and spoiled material taken out of the silo. There was practically no spoiled material on the bottom, although the green clover was placed directly upon the bare earth. The only serious amount of waste was on the top of the heap; this was thought to be caused by the rainwater soaking through the earth covering. This could be prevented by roughly thatching the heap with straw "battens" or straight bundles on the top of the earth covering. It appears best roughly to thatch on the outside of the earth rather than inside, as the main object of the earth is to keep out the air, and if the thatch were placed inside the earth a layer of air would come in contact with the silage.

This method of making silage, although admittedly less perfect than the cylindrical silo method, has the great advantage that no heavy initial expenditure on buildings or on chaffing and blowing machinery is involved. It appears eminently

suitable for small farmers and small holders, and its use may easily prevent the loss of succulent material such as a second crop of clover, second or third crop lucerne, and similar crops which are available at a time of the year when, especially in the Midlands and North of England, it is difficult to make good hay owing to heavy dews and short days.

The following analyses were kindly made by Mr. G. S. Robertson, M.Sc., of Chelmsford. It will be noticed that the percentage of moisture in the clover and rye-grass silage is high, owing undoubtedly to the moist state of the crop when placed in the trench.

	Tares and Rye (chiefly Rye). (Mr. W. Makens).	*Clover and Rye-grass (chiefly Clover). (Mr. John Oldershaw).*
Moisture	64·26	81·41
Oil	1·59	1·05
Albuminoids	3·87	3·40
Carbohydrates ..	13·79	5·28
Fibre	14·30	6·46
Ash	2·19	2·40

The accompanying photographs show the operation of removing the silage from the trench on Mr. John Oldershaw's farm.

AIR POLLUTION BY COAL SMOKE.

ARTHUR G. RUSTON, B.A., B.Sc. (Lond.), M.Sc. (Leeds),
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AMONG the many subjects that in recent years have engaged the attention of those interested in the improvement of the public health of our city communities, the question of atmospheric pollution has obtained a place which is slowly gaining in importance. The subject is commonly discussed, however, as if the pollution were rigidly confined within the municipal boundaries, and solely of importance in its bearing upon the health of the ratepayer and the appearance and durability of his property. In view, however, of the undoubted damage done by smoke pollution to vegetation in general and to garden crops in particular, the question has also a significance for the agriculture of the neighbouring semi-urban districts.

Comparison of Domestic and Boiler Soot.

A good coal contains a large amount of carbonaceous matter, leaves a small residue of ash on burning, and has a low sulphur and arsenic content. When coal is burnt some of the carbonaceous matter escapes into the air in the gaseous form, either as carbon monoxide or carbon dioxide; some distils and comes over as tar; some goes up the chimney unconsumed and is deposited as soot. When one considers the varying conditions under which coal is burnt, it is obvious that the character and composition of soot must vary considerably. The higher temperature and stronger draught of a factory furnace produce a soot which contains more ash and less tar than is the case with the domestic grate. The soot also varies in character with the distance at which it has been deposited from the grate; another factor which will influence the character and composition of the soot will be the kind of coal used.

The following analyses illustrate these facts very clearly:—

Analyses of Soot from the University.

	Domestic Soot.	*Boiler Soot.*		
		Base.	*70 ft. up.*	*Top 110 ft.*
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Carbon	40·50	16·66	21·80	27·00
Hydrogen	4·37	0·86	1·44	1·68
Nitrogen	4·09	0·00	1·18	1·21
Ash	18·16	75·01	66·04	61·80
Tar	25·91	0·09	0·80	1·66
Sulphur	2·99	2·67	2·58	2·84
Chlorine	5·19	0·11	1·46	1·60
Arsenic	—	0·078	—	0·12
Acidity as H_2SO_4	0·37	1·33	0·58	0·56

The differences between the domestic and boiler soot, thus obtained from the same coal, are striking and instructive. The sample from the base of the boiler chimney is little more than dust; practically all the hydro-carbons have been burnt, while what few have volatilised have at the temperature there prevailing no chance of recondensing. Further, the more volatile constituents, ammonium-chloride and sulphate, and arsenic, accumulate. The sample of domestic soot is typical of all those which have been analysed by reason of its high content of tar and volatile substances and its low content of ash. In some samples of domestic soot the amount of tar may even reach as high as 40 per cent.

Impurities in the Air due to Smoke.

With a view to estimating the nature and amount of the impurities in the air of an industrial town, ten representative stations were selected in Leeds, and one on the University Experimental Farm at Garforth, some $7\frac{1}{2}$ miles due east of Leeds. Of the Leeds stations some were in the heart of the industrial area, and others in various residential quarters. The impurities are partly in the form of suspended matter, consisting of soot, tar, sand and mineral matter; and partly in solution, consisting of sulphurous and sulphuric acids or their salts, chlorides, largely in the form of hydrochloric acid or common salt, and nitrogenous matter.

The figures as to the amount of solid impurities in the air taken at the different stations showed that the impurities diminished rapidly from the industrial area northwards into an agricultural area. In the centre of the town the yearly deposit was 850 lb. to the acre; less than a mile north the figure fell to 400 lb.; and just over two miles to the north it fell to 150 lb., or little more than one-sixth of the deposit in the centre of the town. The investigation showed that in the chief industrial centres of Leeds the solid impurities due to smoke pollution are roughly twenty times as abundant as in the purer atmosphere some three miles north-east, in the agricultural country.

By far the most deleterious and objectionable of all the suspended impurities is the tarry matter. At all stations an appreciable amount of tar was found to be deposited, the amount being greatest in and near the industrial area and diminishing rapidly towards the north.

It is interesting, however, to note that the suspended matters in the suburban areas, though smaller in amount, are much richer in tar than those of the industrial area. There is thus

a characteristic difference between the contamination arising from the factory shaft and that attributable to the very imperfect combustion of the domestic range.

Effect on the Growth of Plants.

The solid impurities, present in the air of towns and due to pollution by coal smoke, play a very important part in detrimentally affecting the growth of plants. Their effect in diminishing the amount of sunlight in industrial towns may be gathered from the fact that, in 1907, the number of hours of bright sunshine registered in the centre of Leeds was 1,167, as compared with 1,402 at Adel, some four miles to the north. In other words, the smoke-cloud hanging over the centre of the town curtailed the duration of bright sunshine by about 17 per cent. If, however, there is measured, not the number of hours of bright sunshine, but the actual intensity of the light, it is found that not only is there a greater curtailment, but that there is a sharply defined correlation between that intensity and the known solid impurities in the air.

In Hunslet, in the centre of the industrial area, fully 40 per cent. of the light was shown to be shut off. The energy of sunlight is required by the green leaf for the conversion of carbon dioxide into carbohydrates, and when 40 per cent. of that energy is cut off by the smoke cloud, the effective growth of the plant must be very seriously checked.

Further, the greater part of the material of which the leaves of plants is composed is taken from the atmosphere. The leaves of plants possess minute pores, or stomata, by means of which they absorb carbon dioxide from the air, this carbon dioxide being converted in the plants into starches, sugars, or other carbohydrates. Soot, as has already been pointed out, is not pure carbon, but contains varying amounts, occasionally as much as 40 per cent. of a thick oil or tar, which causes the soot to adhere tenaciously to vegetation, so that it cannot easily be removed by the rain. It thus hinders the intake and assimilation of carbon dioxide necessary to the growth of the plant. The black adhesive film which thus settles on vegetation affects the leaves of trees and evergreens in particular.

In addition to blackening the vegetation the black deposit covers the whole leaf with a kind of varnish and fills up the pores or stomata, thus effectively checking the natural process of transpiration and assimilation. Evergreens suffer most in

this respect because they are also affected by the winter smoke ; of the evergreens the most susceptible, owing to their characteristic sunk stomata, are the conifers.

Effect of Acid in Soot on Growth of Plants.

The samples of soot were also nearly all found to be distinctly acid in reaction to methyl orange, thus indicating the presence of free mineral acids. The amounts of these acids thus brought down by the rain were found in the more polluted parts of Leeds to be as great as eighty pounds per acre. The deposition of acid along with soot upon the leaves of plants is probably one of the main causes of the early withering which is so characteristic of many forms of town vegetation. Ash trees in the purer parts of Leeds often retain their leaves six weeks longer than those in the more contaminated districts.

If, therefore, we regard the leaf as the factory of the plant, we find that, owing to smoke pollution, the factory is actually closed for six weeks out of the four or five months of its working year, while during the remainder of the time, as our assimilation experiments show, it will be working at less than half its normal pressure.

The presence of smoke contamination is usually made manifest by an increased sulphur content in the leaves of trees. From observations made at Leeds it appeared that in the more smoke-infested areas there is not only an increased deposit of sulphur compounds with the soot upon the surface of the leaves, but that there is also an increased intake of sulphur dioxide, which, owing to its germicidal action, tends very considerably to lower the stamina and vitality of both plants and animals.

Sulphuric Acid in Rain Water.

Sulphur dioxide, on coming in contact with air and moisture, passes rapidly into sulphuric acid. The presence of sulphuric acid in rain water has a harmful effect on the vegetation, and excessive acidity may check growth altogether. Grasses watered with water, the acidity of which was 32 parts per 100,000, were killed off in little more than three months, and not a trace of vegetation of any kind was visible in the following spring ; while water, the acidity of which was 16 parts per 100,000, proved fatal in less than a year.

It was also shown that while the final effect of acidity was to destroy vegetation altogether, smaller amounts had the effect of reducing both the quantity and the quality of the herbage. Thus, in every case a larger amount of acidity meant a decreased

yield, an increased fibre content, indicating that the grasses were indigestible, and a decreased protein content, indicating a low feeding value. The effect of the acidity in the soil itself was shown most markedly in the reduction in the number and activity of the soil bacteria, of which the most valuable and at the same time the most sensitive are the nitrifying organisms.

The results of the bacteriological investigation of the soils revealed the fact that while the activity of the "ammonia-producing" organisms was cut down by 42 per cent. by the application of the acid waters, the activity of the nitrifying organisms was cut down by more than 88 per cent.

Effect of Acidity on Soil Bacteria.

Under normal conditions, the protein present in the organic matter in the soil is seized on by the first group of bacteria, the putrefactive organisms, and it is their work to break the protein down into ammonium compounds. The ammonium compounds, however, should not accumulate. A normal soil rarely contains more than four parts per million of nitrogen in the form of ammonia. Other organisms are waiting for these ammonium compounds and convert them first of all into nitrites and finally into the finished products nitrates. While in a normal soil the ammonium compounds are converted first into nitrites and then into nitrates almost immediately, other conditions may prevail in abnormal soils. The nitrifying organisms are much more sensitive and more easily damaged than are the putrefactive organisms, and particularly are they susceptible to acid conditions. Hence, if the workers in the nitrate factory of the soil have to put up a fight against hostile acid conditions, it will be the nitrifying department which will close down first; and, if the ammonia-producing organisms are still able to go on working, this will result in an accumulation of ammonium compounds in the soil Such or similar conditions are to be found in many of our town gardens, and on the farms in and near industrial areas. The acid rainfall is sufficient to keep in check the nitrifying organisms, though not perhaps powerful enough to prevent the more vigorous putrefactive organisms from continuing their work; and the amount of nitrogen in the form of ammonia may rise to as much as twenty parts per 100,000.

On the other hand, the acid conditions in the soil may become so unfavourable to the growth of bacteria that even the putrefactive organisms are unable to work. In this case there will remain in the soil an accumulation, not of nitrates—the

finished product, nor of ammonium compounds—the intermediate product, but of undecomposed organic matter—the raw product. This is noticeable in the soil of one area in Leeds where, owing to the abnormal pollution of the atmosphere, even the ammonia-producing organisms are killed off. It can also be seen in the accumulation of matted roots in many old pastures, particularly in smoke-infected areas.

Effect of Acid Conditions on Grass Land.

In some fields at Garforth, beneath the actual turf lies a mat, 4 to 6 in. deep, of undecayed vegetable matter, because the soil is so acid that even the vigorous putrefactive organisms are unable to continue working.

Grass land, possessing such a layer of undecomposed peat above the soil, will suffer severely in times of drought, burning up and turning brown quickly. The peaty mat will absorb any rain which falls, to such an extent that heavy and prolonged rain is required to wet the soil below. In 1917 the country suffered a period of practical drought from the middle of April until the end of July. August, on the other hand, was a month of heavy and continuous rain; yet at the end of the month, although rain had fallen 28 days out of the 31 and the total rainfall for the month had been more than $6\frac{1}{4}$ in., the soil below the peaty mat was quite dry and powdery. Many of the soils on the coal measures in the West Riding of Yorkshire are naturally deficient in lime, and, where this deficiency is accentuated by smoke pollution, they may require as much as 2 or even 3 tons of quicklime per acre to neutralise the acidity. Once this acidity is neutralised by the application of chalk or lime the putrefactive organisms can work, and the mat disappears. In November, 1911, estimates were made of the water-contents of the soil taken from two adjacent plots at Garforth. The soil from one plot, which had received a dressing of 6 tons of quicklime per acre in December, 1898, contained 22 per cent. of moisture; whereas the soil from the second plot, which had received no dressing of lime and which had a thick mat below the turf, only contained 8 per cent. of moisture.

Deficiency of Lime due to Acidity in Soil.

It has already been pointed out that the acid rains tend to neutralise the free lime present in the soil, the calcium sulphate thus produced being washed out and finding its way into the drains. This action naturally tends to leave the soils poor in "available lime." Practically none of the soils on the farm

at Garforth contains more than 0·2 per cent. of free lime; most of them contain considerably less. If there is a deficiency of lime in the soil, it is only natural to expect a deficiency of lime in the crop growing on that soil. For bone formation, the ratio of lime (CaO) to phosphoric acid (P_2O_5) should be approximately 1 : 1. In green foods like grass, hay, turnip-tops, etc., lime is in excess; in the cereals and concentrated foods phosphoric acid is in excess. The ratio of lime to phosphoric acid in normal meadow hay is approximately $2\frac{1}{2}$: 1; in normal seeds' hay the ratio is approximately $3\frac{1}{2}$: 1. Thirteen different samples of hay produced on the farm at Garforth have been analysed, and the average resulting ratio of lime to phosphoric acid in the samples has been, not 3 : 1, but 1·12 : 1. Since hay and grass are practically the only foods fed to cows where the lime present is in excess of the phosphoric acid, and since the ratio, phosphoric acid to lime, is :—

in linseed cake	4 : 1
in cotton cake	10 : 1
in coconut cake	3 : 1
in palm nut cake	4 : 1
in ground oats	7 : 1

it is to the hay and grass that the cow must look to make up the deficiency of lime in the other foods. In a normal milk the lime and phosphoric acid are usually present in approximately the same proportions as are required for bone formation, and the ratio of lime to phosphoric acid approximates to 1 : 1, and rarely falls below 1 : 1·25.

Some two or three hundred samples of milk produced on the farm at Garforth have been analysed, and all have shown a considerable deficit in lime, the average ratio of the samples analysed being not 1 : 1, but 1 : 1·54, and in some cases being nearly 1 : 2. This poorness in lime of the milk produced in our industrial areas is a matter of considerable importance.

Economic Effects of Smoke Pollution.

The economic effects of smoke pollution with its deposits of tar and acid upon the grass land in the smoke areas are enormous. The leguminous plants and finer grasses disappear and the herbage usually consists of bent, Yorkshire fog, woodrush, sorrel, yarrow and moor grasses, while the feeding value of the coarse grasses and weeds which survive is considerably reduced.

This deleterious effect on vegetation is also reflected in the diminished stock-carrying capacity of the land; and land

which some thirty years ago was carrying two bullocks to the acre will now carry less than one head of stock to three acres.

In many cases the pollution of the air by coal smoke has resulted in an economic loss of rent. An instance may be quoted of land near one of the coal mines in the Barnsley district, where the rent which in 1887 was 52*s.* 6*d.* per acre was reduced in 1890 to 27*s.* per acre on condition that no claim was made for damage from smoke pollution. In 1900 the rent was again reduced to 20*s.* per acre, and in 1902 further reduced to 10*s.* per acre. At the present time this land consists of little more than derelict grass land, or barren arable land growing practically nothing but stunted sorrel and spurrey.

Electrification Experiments.

The results of experiments carried out at Garforth showed that the electrification of the atmosphere brings about a heavier deposition of soot particles, and that these soot particles acted as nuclei of condensation for other smoke products.

	Parts per Million.	
	Electrically treated.	*Untreated.*
Suspended matter	270·8 ..	81·0
Tar	15·3 ..	3·8
Acidity as H_2SO_4	10·3 ..	10·6
Sulphur as SO_3	33·2 ..	15·6
,, SO_2	7·2 ..	0·36
Chlorine	24·9 ..	10·3
Nitrogen as NH_3	4·120 ..	1·481
,, N_2O_5	0·813 ..	0·493
,, albuminoid ammonia	0.434 ..	0·167
Total nitrogen	5.367 ..	2·041

If these results generally hold good, they indicate that while the electrification of plants may prove beneficial in the rural districts, the process cannot be used to advantage in the districts where its value might be greatest, such as the market gardening districts in the neighbourhoods of the industrial areas. In such areas the intensified smoke effects would more than counterbalance the good effects which would otherwise result from the electrical treatment.

Summary of Conclusions.—The main detrimental effects of air pollution by coal smoke upon vegetation may be summarised as follows :—

1. The cloud of smoke blocks out the sunlight, and thus reduces the available solar energy by, in some cases, as much as 40 per cent.

2. The thick deposit on the leaves of plants and trees, still further blocks out the light.

3. The choking of the stomata by the tarry, glutinous matter tends to asphyxiate the plant, and effectively to check its power of assimilation of carbon dioxide.

4. The presence of free acids in the air tends generally to lower the vitality of the plant.

5. The free acids falling on the soil make it sour, and thus limit the activity of the soil organisms, which must work freely, if the soil is to maintain its fertility.

While it is only possible to reduce the first three effects of smoke pollution enumerated above by checking the output of smoke, and using every effort to lessen the air pollution, the remedy for the last lies in the hands of the farmers themselves.

The acidity of the soil can be neutralised by a *judicious application of lime*; in a smoke-infested area a dressing of lime at least once in a rotation should be regarded as essential, and the lack of such dressings has been responsible in many cases for the failure of a crop, particularly of roots and barley.

DECAY IN POTATO CLAMPS DUE TO "BLACK-LEG,"

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THE very large amount of rotting of potatoes in storage which occurred throughout the country, and especially in the Fen district, during the early winter of 1918, led the Board of Agriculture to investigate the cause of the trouble, and Messrs. A. D. Cotton and H. V. Taylor, officers of the Ministry, made a thorough inspection of the clamps in the districts most affected. An account of this inspection, with the first impressions of the investigators as to the causes of the decay, together with a complete discussion of the general question of decay of potatoes in clamps, are contained in an article which appeared in a Supplement (No. 18) entitled "The Cultivation, Composition and Diseases of the Potato," published with the issue of this *Journal* for March, 1919.* One of us (S. G. P.) was asked to be present during the last inspection, when two farms in the neighbourhood of Spalding, Lincolnshire, were visited.

The clamps on these farms were not the worst cases that were seen, but their condition was extremely bad; wreaths of "steam" were rising in the winter air to a height of 4 or 5 ft. above the tops of the clamps, and, after removal of the straw, a thermometer was inserted to a depth of 9 in. amongst the topmost potatoes, and registered a temperature of 60° C. In one instance the top of the clamp had subsided in lengths of 10 to 30 ft. as a result of the conversion of the potatoes into a condition of sludge. When the clamps were opened, many of the potatoes at the top were sweet-smelling but soft in texture, and appeared to be par-boiled, but otherwise unaffected. Large quantities, however, were reduced by bacterial action to a stinking pulp. Several specimens of the tubers which were least diseased were collected for bacteriological examination. These were found to contain a very mixed bacterial population, in which saprophytic forms, such as *Bacillus mesentericus*, *B. subtilis* and *B. mycoides* predominated. Portions of the pulp were placed upon sterile slices of potato and maintained at different temperatures; at room temperature there was,

* Copies of this Supplement may be obtained on application to the Secretary, Ministry of Agriculture and Fisheries, 3, St. James's Square, London, S.W. 1, price 6*d*. net.

apart from a few exceptional cases, no effect beyond the softening of the surface tissue to a depth of one or two millimetres. At 20° C., in every case the whole of the tissue rotted completely in three or four days. The colour of the rotted tissue was at first quite white, but became greenish-yellow on the second day and remained this colour for seven or eight days, when the colour changed to pink.

From the greenish-yellow tinge of the tissue *B. xanthochlorum* (Schuster) was suspected as the cause of the decay, but on transferring repeatedly from the margin of the diseased area to fresh potato slices this colour was observed to become less prominent, and it eventually failed to appear at all. The rotting effect continued actively in the absence of the yellow-producing organism, which was evidently a saprophyte. The character of the rotted tissue indicated the "Black-Leg" bacillus (*B. atrosepticus*) as the causal organism. The rotted tissue was perfectly white in the unexposed portions and fleshy-pink at the surface, where it was exposed to light and air. Platings which were made from these rotted potato slices gave pure cultures of an organism which agreed in morphological characters with *Bacillus atrosepticus* and gave also all the reactions by which this organism is recognised. Inoculations of potato stems and bean stems gave rise to the symptoms of "Black-Leg," thus leaving no doubt as to the identity of the organism.

"Black-Leg" is well known as a cause of rotting in stored potatoes. The disease had not been observed by the farmers in the fields from which these crops had been taken, but this signifies little, since it is well known that a late attack of "Black-Leg" will not show itself to any very obvious extent in the "tops," and the presence of the organism in the tubers can only be recognised by cutting the tuber longitudinally through the "heel."

From the cultural experiments recorded above it is certain that the "Black-Leg" bacillus was largely responsible for the damage in the particular cases investigated, but the question as to whether it was responsible for the commencement of the trouble or whether one of the other agencies enumerated by Cotton and Taylor was concerned must be left open. It is also unknown whether the presence of *B. atrosepticus* was general in the rotted potatoes throughout the country, but it is, at least, significant that trouble from "Black-Leg" was worse than usual during the past summer.

In order to prevent losses during storage it cannot be too strongly emphasised that extreme care should be paid to the construction and ventilation of the clamps. The practical suggestions given by Cotton and Taylor on pages 58 and 59 in the article referred to above, should be closely followed. The main safeguard is to keep the potatoes dry and well aired. A method of ventilation in common use in Germany, but scarcely ever seen in this country, consists in the laying of poles along the ridge of the clamp after the first layers of straw have been spread over the potatoes. Further layers of straw are laid over these poles, and finally the earth casing is put on the clamp. Channels on either side of the poles, running the length of the clamp, and open to the air at both ends, are thus provided. The ready entrance of rats and mice into these open ends should be prevented by means of galvanised wire netting of suitable mesh.

IDEAL HOMES EXHIBITION:

THE MINISTRY'S MODEL ALLOTMENT.

IN pursuance of a definite policy of Horticultural Education, the various County Authorities in England and Wales have been approached by the Ministry and asked to set up special committees whose duty should be the fostering of commercial and domestic fruit and vegetable cultivation to meet the requirements of the respective counties.

With the object of making suggestions as to the lines on which demonstration plots might be set up, special plans dealing with allotments, market-gardening and fruit have been sent to each County Authority. Many of the counties have already adopted the scheme in its entirety, and others have modified it to suit the particular types of cropping most suited to districts in which the plots have been set up. It is hoped that eventually every County in England and Wales will carry out some portion of the scheme.

In the case of the allotment, the scheme should have a practical application to every part of the country, and although the summer, autumn and winter cropping will have to be modified to suit the altitude, latitude and general climatic conditions prevailing in different districts, the arrangement of the general crops will hold good over the whole country.

Towards the close of 1919, the *Daily Mail* approached the Ministry with a view to obtaining suggestions for the cropping of a vegetable plot which might be worked by the prospective tenants of the types of cottage to be shown at the Ideal Homes Exhibition in February. It was suggested by the Ministry that the model allotment showing the cropping, soil preparation and manuring, as these operations appear in the month of February, would be a suitable exhibit. This was provisionally offered, but when the promoters of the Exhibition approached Messrs. Sutton & Sons of Reading, that firm immediately proposed to produce the full cropping scheme as it would appear in June under normal climatic conditions.

Although only five weeks were available to get the crops ready, the allotment appeared on 4th February fully cropped as it should appear in June. It proved a source of great interest to those visiting Olympia, and was undoubtedly of great educational value. Addresses were given each evening,

and the interest and enthusiasm manifested by the large audiences which attended were ample recompense to all concerned.

Questions were numerous, and copies of the Ministry's leaflets dealing with horticulture were distributed at the Exhibition.

The plan and photographs will give some idea of the principles on which the cropping is based and the general appearance of the plot with the crops in full growth.

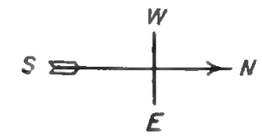
Potatoes were earthed up, leeks and celery were in their trenches, peas were almost in bloom, and runner beans were starting to climb their sticks. Onions, beet, carrots, parsnips, turnips, marrows and shallots were all several inches high, while rhubarb, spring cabbage and lettuces were ready for gathering. The whole plot was surrounded by an edging of turf which gave a pleasing and natural finish to the exhibit. The crops on the allotment are so managed as to admit of one-third of the entire area becoming vacant each year to allow a portion to be "double-dug" or bastard trenched, but this does not do away with the necessity for deep working of the entire area when the allotment is first broken up. A three years' rotation is shown on the plan.

Provision is also made for the sowing of crops which may be dug into the ground in the green state to meet the great and ever increasing shortage of farmyard or corporation manure. The general application of artificial manures in the various sections is also indicated.

Everything connected with the exhibition was intended to be educational. Thousands of people examined the plot and listened to the lectures, and from the general trend of the questions asked, there would appear to be still an *appalling amount of ignorance with regard to soil working, manuring and general cultivation*. There is, therefore, a very large field of work open to County and Municipal Authorities in educating the allotment holder and thus raising the standard of cultivation all over the country. It is quite safe to assume that, taken as a whole, not over 50 per cent. of the possible tonnage per acre is at present being obtained from allotments, although there are outstanding cases where almost maximum returns are being secured. Allotments were increased during the War from 500,000 to 1,500,000, and despite the fact that many war areas have had to be given up, the present allotments in England and Wales are computed to aggregate 1,750,000 and are still increasing. This is ample proof that the so-called

MINISTRY OF AGRICULTURE & FISHERIES

ALLOTMENT CHART



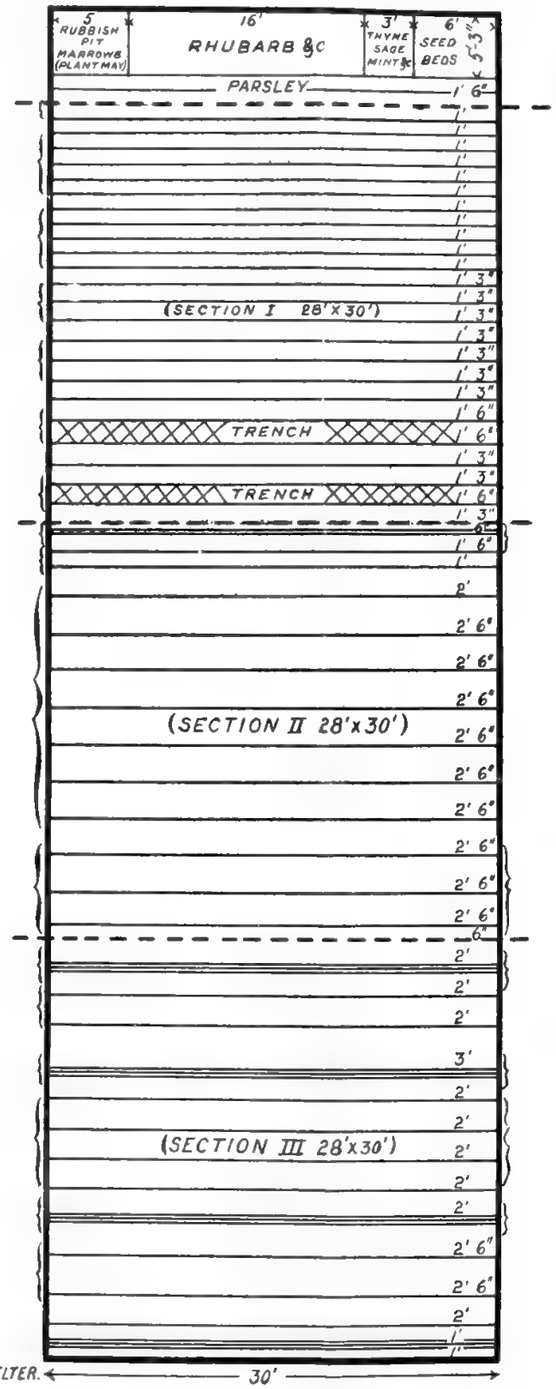
NOTE.—The system shown on this Chart can be successfully followed in most of the Southern and Midland Counties by making due allowance in the sowing and planting dates. In parts of the Northern Counties it may not be possible to mature the autumn-sown crops. Special local conditions should, in all cases, be considered and the plan modified accordingly. The cropping is arranged to give a proper proportion of each crop for the average household, and to give, as far as possible, a continuous supply of produce. A three-year rotation is combined in order that similar crops are not grown on the same soil for more than one year in any three. The sowing and harvesting times are so arranged that the major portion of one section each year becomes vacant in order that it may be "double dug."

DIMENSIONS OF PLOT 30FT X 90FT 9IN = 10 SQUARE RODS, POLES, OR PERCHES = 302½ SQ. YD.

SPRING & SUMMER CROPPING

SEASON OF USE	WHERE SOWN	TIME OF SOWING	TIME OF PLANTING OUT	CROP	NO OF ROWS
SEPT to MARCH	— —	PURCHASED	EARLY MARCH	ONIONS, AUTUMN SOWN	2
SUMMER	WHERE GROWN	EARLY MARCH	— —	ONIONS, SPRING SOWN	5
SEPT to MARCH	WHERE GROWN	EARLY APRIL	— —	CARROTS, Main Crop	5
OCT. to MARCH	WHERE GROWN	FEB & MAR.	— —	PARSNIPS	3
SEPT. to MARCH	WHERE GROWN	END of APRIL	— —	BEET, Main Crop	3
JULY to SEPT.	WHERE GROWN	EARLY APRIL	— —	BEET, Summer	1
JUNE - JULY	SEED BED	EARLY MARCH	APRIL	LETTUCE, on ridge	1
OCT. to MARCH	SEED BED	END of FEB.	APRIL-MAY	LEEKS, in French	2
JULY - AUGUST	WHERE GROWN	MIDDLE APRIL	— —	DWARF BEANS, on ridge	1
OCT. to JAN.	— —	PURCHASED PLANTS	JUNE	CELERY, in French	2
APRIL - MAY	WHERE GROWN	MARCH	— —	RADISH, on ridge	1
JUNE - JULY	WHERE GROWN	FEB. or MAR.	— —	BROAD BEANS, double row	1
JULY to FEB	(PURCHASED or	SAVED SETS)	FEB. or MAR.	SHALLOTS	2
OCT to JUNE			MIDDLE APRIL	POTATOES, main crop	7
AUGUST-SEPT.			EARLY APRIL	POTATOES, 2nd early	3
LATE JULY	WHERE GROWN	MIDDLE APRIL	— —	PEAS, mid-season	1
JULY ONWARDS	SEED BED	EARLY MARCH	APRIL	CABBAGE, summer	2
EARLY JULY	WHERE GROWN	END MARCH	— —	PEAS, mid-season	1
JULY-AUGUST			MIDDLE MARCH	POTATOES, early	4
JUNE	WHERE GROWN	EARLY MARCH		PEAS, early	1
NOVEMBER ONWARDS	SEED BED	MARCH	MAY-JUNE	BRUSSELS SPROUTS over	2
JUNE-JULY	WHERE GROWN	MARCH	— —	EARLY TURNIPS or CARROTS	
JULY ONWARDS	WHERE GROWN	EARLY MAY	— —	RUNNER BEANS with	1
MAY	SEED BED	PREVIOUS SEPT.	MARCH	EARLY LETTUCE between	

NOTE:- POSITION OF RUNNER BEANS AT EAST END OF PLOT IS PERMANENT TO PROVIDE SHELTER.



AUTUMN & WINTER CROPPING

NO OF ROWS	CROP	TIME OF PLANTING OUT	TIME OF SOWING	WHERE SOWN	SEASON OF USE
2	ONIONS		AUGUST	WHERE GROWN	SUMMER FOLLOWING
3	SPRING CABBAGE	SEPTEMBER	JULY-AUGUST	SEED-BED	FOLLOWING SPRING
1	KALE or BORECOLE	AUGUST	APRIL	SEED-BED	WINTER
2	BROCCOLI	JULY	APRIL	SEED-BED	WINTER
4	CAULIFLOWER OR SAVOY	JULY	APRIL	SEED-BED	AUTUMN & WINTER
2	BROCCOLI	JULY	APRIL	SEED-BED	WINTER

CULTIVATION, MANURING, ETC.—The period covered is from November 1st to October 31st.

SECTION I.—Double-dig all vacant ground during November, incorporating all available decaying vegetable matter, burnt garden refuse, ashes, and rubbish. Dress with 12 lb. Basic Slag, and 3 lb. of Sulphate of Potash (or 6 lb. of Kainit). Plant and crop as shown in table. (If desired, the Sulphate of Potash may be applied in February just before sowing.)

SECTION II.—Dig deeply all vacant ground in November. In March dig lightly and incorporate 12 barrow-loads partly-decayed farmyard or stable manure, 3 lb. of Sulphate of Potash (or 6 lb. Kainit), 6 lb. Superphosphate, and any available burnt garden refuse. At earthing time dress potatoes with 3 lb. Sulphate of Ammonia. (On heavy soils farmyard manure may be applied during the November digging.)

SECTION III.—Dig deeply all vacant ground in November or December and incorporate 12 barrow-loads of decayed farmyard or stable manure, 3 lb. Sulphate of Potash (or 6 lb. of Kainit), and 6 lb. Superphosphate. In February rake in a dressing of 40 lb. lime.

ROTATION	SECTION I	SECTION II	SECTION III
1st YEAR	AS SHOWN ON CHART	AS SHOWN ON CHART	AS SHOWN ON CHART
2nd YEAR	AS SECT. III	AS SECT. I	AS SECT. II
3rd YEAR	AS SECT. II	AS SECT. III	AS SECT. I

PERMANENT CROPS, ETC.—At the western end of the plot a portion is reserved for Seed beds, Marrow bed, Rhubarb, and rubbish heap. A hut, if needed, could also be placed here. If a hot bed and frame is used Marrows can be sown in April and planted out in May. Sow Parsley in April.

GREEN MANURING.—Where stable or farmyard manure is difficult to obtain, the supply of humus to the soil can partly be maintained by growing a crop of mustard after the early summer vegetables in place of the autumn crops. The mustard should be sown as soon as the ground is clear, and dug in green before the frost comes. Rye may be sown in September and October as the ground becomes vacant, and dug in about the end of March.

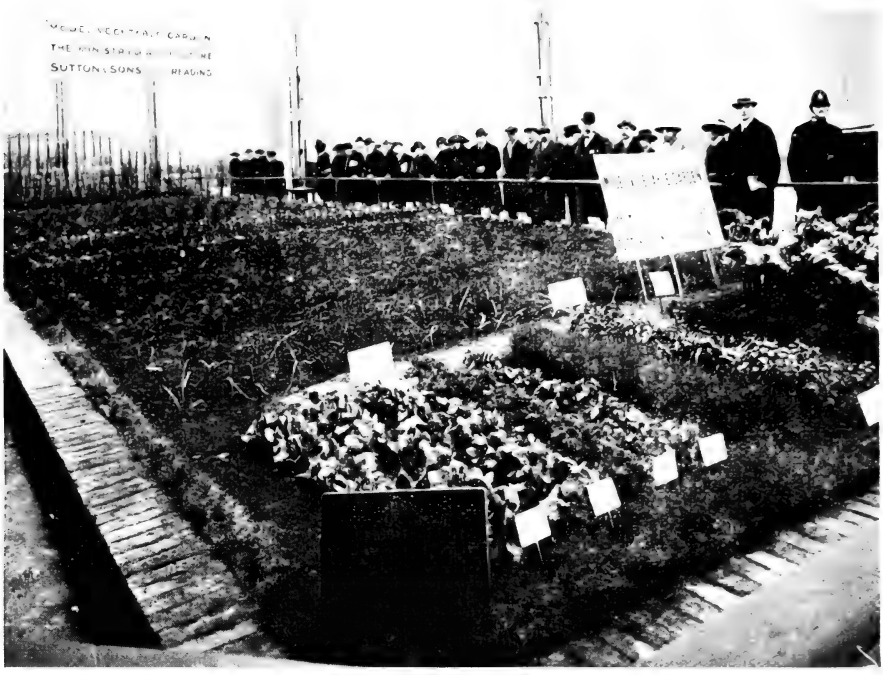


FIG. 1.—Model 10-rod Allotment, fully cropped, according to the Ministry's plan. The crops appear in February at the stage of growth usually obtaining in June.

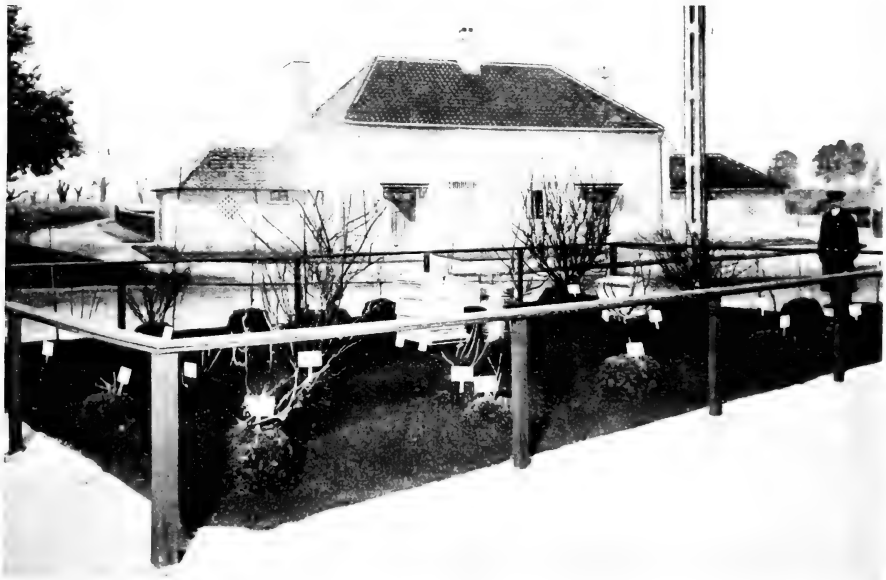


FIG. 2.—Fruit Tree and Bush Fruit Exhibit at Olympia, February, 1920. (Illustrating correct and faulty methods of pruning.)

FIG. 3.—Bush Apple Tree (9 years old). On Paradise Stock, judiciously thinned and systematically pruned.

FIG. 4.—Bush Apple Tree (9 years old). On Paradise Stock, showing neglected condition from lack of pruning over a period of years.

war craze for food production has not been a spasmodic or temporary effort, but has come to stay, and that the number of allotments is likely to continue to increase in the future.

To raise their productivity by even 20 to 30 per cent. is a work well worthy of the efforts of the Ministry, and it is hoped to accomplish it by combining systematic lecture courses and practical demonstration work (by means of model plots) with private effort. The value of the extra produce would run into millions of pounds sterling, and the general commercial market-gardening of the country would not be detrimentally affected.

The allotment movement has been responsible for a greater consumption of vegetables amongst the working classes, and in thickly-populated areas householders not possessing allotments have vied with their neighbours and purchased on the open market to a greater extent than previously to furnish a greater variety for the table.

All this has tended to the national good and helped to build up a healthier and more independent population. The social and moral influences of the allotment movement may possibly prove incalculable, for no man can cultivate properly a small piece of ground without being brought face to face with the problems of nature and being made to think, and in the majority of cases the effects of the environment of the allotment will be to make him a better man intellectually and socially.

Fruit Tree and Fruit Bush Exhibit.—Being aware of the ignorance which exists amongst amateurs and small holders generally with regard to the pruning of fruit trees and bushes, the Horticultural Division of the Ministry arranged with Messrs. Spooner of Hounslow to exhibit a certain number of specimens which they considered would prove of educational value. The trees were pruned by the Ministry's experts and have been carefully examined by great numbers of those visiting the exhibition.

The demonstrations were so apparent as to appeal at sight to the novice, but all were labelled in bold type with the object of enlightening cottagers and villa gardeners who possess a few specimens or who may desire to plant their gardens in the near future.

Bush apple trees were shown on the Paradise stock as they usually appear when purchased from the nursery, and during the first, second, third, and fourth year of their growth. In each case the pruned and unpruned specimen was shown. In addition, the novice was shown a neglected bush apple

tree, nine years old, similar to thousands which can be found in rural suburbs, while alongside a similar tree, renovated by judicious thinning out of the branches and pruning of the laterals so as to bring it into a profitable fruit-bearing condition, was shown.

The formation of a half standard apple, plum and pear, was illustrated by pruned and unpruned specimens.

Small fruits were represented by two-year-old gooseberry, and black and red currant bushes, illustrative of the method of cutting down after planting. A neglected gooseberry and black currant bush were also shown, with a similar bush pruned systematically. Modern types of cordon gooseberries and red currants pruned and unpruned occupied one section of the exhibit.

The trees and bushes were inserted in pots and tubs and carefully mossed over, and the whole was set on a groundwork of red gravel giving a clean and pleasing effect to the whole exhibit.

The enthusiasm displayed and the information imparted would appear to justify similar procedure at other large shows or exhibitions in the provinces.

AGRICULTURE ABROAD.

RECLAIMING HEATH LAND IN DENMARK—SETTLING EX-SERVICE MEN IN NEW SOUTH WALES—IMPROVING GRASS LAND IN BAVARIA.

The Danish Heath Society.

THE wave of patriotic feeling which swept over Denmark after the disastrous war of 1864, when North Schleswig passed into the hands of Germany, was the primary cause of the formation of the Danish Heath Society. Through the initiative of Colonel E. M. Dalgas a scheme was prepared in 1866 for the reclamation of the uncultivated land in Jutland. Thousands of people came forward to support the scheme, and subscriptions and donations were given by many communal authorities, saving banks, joint stock companies, and other bodies. Subsequently the Danish Government recognised in a practical manner the valuable work done by the Society, and since 1885 State grants have been made towards the cost of making plantations. The Society has become an agent of the State, and large sums of public money are administered by it. In 1918 State grants amounted to 2,102,856 kr. (about £115,657), whilst subscriptions from members, who now number 9,416, amounted to 47,991 kr. (about £2,640).

The object of the Society is to encourage the cultivation of heath land in Denmark, and although this has been done mainly by instruction, the Society has also embarked directly on many and varied projects. The first and most important was the acquisition of land on its own behalf. Wherever possible this land was prepared and cultivated with ordinary farm crops, but poor land was utilised for the laying out of plantations. Marshes were drained; dry land was irrigated; marl pits were opened in order to provide a plentiful supply of marl and lime for improving the soil; and the transport necessary for the opening up of large areas was provided by the construction of light railways. Later still came the distribution of young plants, at cheap rates, to small holders and farmers.

The Society's field of action, formerly confined to Jutland, now extends over the whole of Denmark. In Jutland alone there existed in 1860 an area of about 2,900 square miles of uncultivated land, either heath or marsh. This area has now been reduced by more than one-half, mainly owing to the work of the Society, though the Danish Government has assisted by the laying out of State plantations.

The number of plantations now under the direction of the Society is 2,232, covering an area of about 195,000 acres. The problem of utilising the wood thus grown was solved in certain cases by the installation of charcoal burning plant, and by the extraction of tar. A considerable trade has also been developed in supplying fence poles and other forms of light timber. Large numbers of young trees, coniferous and deciduous, have been grown on the various plantations, and for a number of years between ten and twelve million plants have been distributed annually.

The search for marl was one of the early labours of the Society, as it was recognised that large areas would require some form of manure to render the soil fertile, and the transport of this by light railway was begun in 1875. The subsequent expansion by the Society of the system of movable light railways was of importance. Up to the end of 1915 the amount of marl transported was about 1,300,000 tons, and the amount of lime about 160,000 tons.

The drainage and cultivation of marsh land took an important place among the activities of the Society. Irrigation canals were made, drainage systems were evolved, embankments and dikes were constructed, and plans and assistance given to a large number of small farmers. About 270 miles of irrigation canals have been made for the improvement of about 17,500 acres of land. Extensive schemes of drainage have been put into operation, and the construction of embankments protects large areas from becoming useless stretches of water-logged land. The institution of numerous demonstration stations and of three large permanent experimental stations has enabled the Society to maintain this important work. From these stations are issued large numbers of plans and instructions for the benefit of small holders who are in a position to carry out improvements on their own behalf.

In the success of the Society's work the co-operation of the individual owner or occupier of the heath land has been a contributing factor of the utmost importance. This has been fostered to a large extent by the educational system obtaining in Denmark, which aims primarily at implanting a love of rural life in the minds of the young. Subsequent training in the advanced schools tends further to develop a taste for those agricultural pursuits which demand a full measure of the national traits of thrift, industry and neighbourliness.

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Land Settlement in New South Wales.

SPECIAL legislative measures have been provided by the Government of New South Wales to assist in the settlement upon the land of persons who have completed their service in the Army or Navy during the War. Large areas of Crown lands have been made available and several large estates have been acquired by purchase, while others are in course of acquisition. On these estates group settlements have been or will be established in order to accommodate communities of soldiers, each soldier having his own individual farm or holding.

In certain cases privately-owned property may be selected by a discharged soldier, and purchased for him by the State, The settler in such cases is required to reside for at least five years on the land and to effect improvements up to stated percentage minimum values.

To meet the requirements of some of those who have not had practical experience, a training system has been inaugurated in conjunction with the Department of Agriculture, and expert officials are available for guidance and advice. Such training, however, will only provide for a very limited number.

In order to help those who may wish to take up poultry-farming, but who may not have had sufficient experience, and also in order that a supply of birds of good quality may be available, a stud poultry-farm has been purchased to serve as a training farm. A state nursery and training farm has also been established at Glen Innes, at which general horticultural work is taught.

Advances up to a maximum amount of £625 are made to provide for the equipment of the farms and to effect the necessary improvements. The terms of repayment of moneys advanced for this purpose, and of payment for the land, are upon a long-deferred system, the instalments being calculated upon an interest basis of not exceeding 3½ per cent. for the first year, 4 per cent. for the second year, and so on, the rate increasing by not more than one-half per cent. for each subsequent year, to a maximum of 5½ per cent.

On certain classes of holdings fortnightly payments are made during the unproductive period to sustain the settler and his family. Such an advance must be repaid by the settler. Sustenance may also be obtained from the Department of Repatriation for a period not exceeding six months in the first two years of occupation if the circumstances so warrant.

Soldiers travelling to inspect land that has been made available and which it is proposed to be used for settlements under the Returned Soldiers' Settlement Act are allowed to travel free on one return journey only.

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Society for the Improvement of Grass Land in Bavaria.*

THE object of this Society is to unite farmers and owners of grass land in an endeavour to promote the improvement of meadows and pastures and fodder crops generally, in co-operation with the Government.

The following are the measures to be taken for the furtherance of this object :—

1. Expert advice and consultation in laying down, cultivating and improving grass land and fodder crops generally.
2. The institution and maintenance of training and experimental centres, and model farms.
3. The establishment of breeding and seed growing stations for the improvement of the local meadow and pasture grasses and other fodder plants.
4. The promotion of common grazing grounds in the interests of small stock-owners.
5. The promotion of sheep pastures.
6. Expert advice and consultation in all questions of manuring.
7. Expert advice and consultation in farm management generally, where questions of grass land farming are involved.
8. Supply of seed and all other necessaries.

The Society's first lectures were given on 5th and 6th January last, and in spite of difficulties of travelling were attended by some seventy farmers from all parts of Bavaria.

* *Deutsche Land. Presse*, 4th February, 1920, p. 76.

QUESTIONS IN PARLIAMENT.

Ploughing Up of Winter Wheat.—In reply to a question by Mr. Royce, the Parliamentary Secretary to Ministry of Agriculture stated that he was not aware that any farmers intended to plough up their winter wheat, but that he had heard that some farmers proposed to cross-drill their wheat with barley or oats to secure a crop of mixed corn, which could be used for stock feeding. Such action would not constitute any offence against the law, but was to be deprecated as being contrary to the national interest. (9th March 1920.)

Muzzling Order.—In reply to a question by Captain Tudor Rees, the Parliamentary Secretary to the Ministry stated that the last case o rabies occurred in Surrey on the 18th February. The Muzzling Orders were at present in force in six different parts of the country. Owing to the abnormally long incubation period which sometimes occurs in rabies, it was not considered safe to free a muzzling area within a period of from six to eight months from the date of the confirmation of the last case. (15th March, 1920.)

Land Settlement.—In reply to a question by Commander Locker-Lampson, the Parliamentary Secretary to the Ministry stated that according to the latest returns received from the Huntingdon County Council, 973 applications had been made to the Council for 16,115 acres. Of these applicants, 692 had been approved for 7,265 acres and 522 had actually been provided with holdings having a total area of 4,549 acres. As regards 219 applicants for 3,569 acres, their applications were standing over either for the purpose of interview or for some other reason. Fifteen other counties had received a larger number of applications for small holdings than Huntingdon, and one county (Isle of Ely) had settled a larger number of men, but he was glad to have this opportunity of congratulating the Huntingdon County Council on the work which they had accomplished in regard to land settlement. He further stated that arrangements had been made in accordance with Section 18 of the Land Settlement (Facilities) Act, 1919, for the Huntingdon County Council to guarantee advances to their tenants for the purchase of live stock, fruit trees, seeds, fertilisers and implements, and in these circumstances he was not aware that the establishment of a land bank was necessary at the moment. (15th March, 1920.)

Tillage.—In reply to a question by Major Howard, the Parliamentary Secretary to the Ministry stated that the total area of land of which the Agricultural Executive Committees are in possession under the Defence of the Realm Regulations is 32,000 acres, of which 12,000 acres are let to farmers and 20,000 acres are being farmed by the Committees themselves. (22nd March, 1920.)

Tuberculosis Order of 1913.—In a reply to a question by Lieut. Colonel Fremantle respecting the Tuberculosis Order of 1913, the Parliamentary Secretary to the Ministry stated that it was anticipated that the Tuberculosis Order, either in its present form, or slightly amended, would come into operation at the same time as the Milk and Dairies Act. The question of employing whole-time veterinary surgeons was under consideration, but the matter was one which presented serious difficulties. The Ministries of Health and Agriculture were acting in close co-operation in this matter, and the possibility of introducing a system whereby herds might be guaranteed free from tuberculosis was under consideration. (15th March, 1920.)

NOTICES OF BOOKS.

Village Clubs and Halls.—Sir Lawrence Weaver, K.B.E. (London: Offices of "Country Life," 1920, 7*s.* 6*d.* net). The object of this book is to present to persons interested in the question of the building of village halls and clubs a number of plans and designs of diverse character in their size, cost of equipment, and architectural treatment, which should be useful for consideration in the construction of such buildings. Illustrations are freely given to illustrate the subject of the text matter. The author first deals generally with the place a club should occupy in the social life of a village, and refers to the Village Clubs Association. He elaborates his subject by treating in detail the construction of halls and clubs, and touches on the cost of erection, materials, and other relative factors. Two chapters are given describing the Kemsing Village Club and the Nettlebred Working Men's Club and Institute, which are quoted as model examples. Appendices are added on (1) How to form a village club, (2) draft rules of village clubs, (3) advantages of affiliation to the Village Clubs Association, (4) Memorandum on educational facilities, and (5) a financial statement on the working of the Nettlebred Working Men's Club and Institute during 1918.

A Course of Practical Chemistry for Agricultural Students, Vol. I.—H. A. Neville and L. F. Newman (Cambridge: University Press, 1920, 10*s.* 6*d.* net). Vol. II., Part I. of this work, which was noticed in this *Journal* for February, 1920, p. 1140, contains exercises in pure organic chemistry. The volume now under review is intended to cover the first year's course on the chemistry and physics of the soil, and is based to some extent on the course of practical work compiled by Prof. T. B. Wood some years ago for the use of his classes at Cambridge. The exercises are designed to illustrate most of the essential points in agricultural chemistry, and require a minimum of apparatus.

Animal Foodstuffs: Their Production and Composition, with a special Reference to the British Empire.—E. W. Shanahan (London: George Routledge & Sons, Ltd., 10*s.* 6*d.* net). This is one of the Studies in Economics and Political Science, edited by the Director of the London School of Economics and Political Science. The first part is devoted to an examination of the conditions of production of meats and dairy and poultry produce in all the important countries, in the course of which it is shown that, even apart from the effects of the War, there was, and is, a growing tendency towards a world-shortage of these foodstuffs.

The second part discusses the various aspects of the question of the consumption of these articles separately and together, and examines the economic relations that exist between the production and consumption in keeping with the technical organisation of agriculture.

The third part deals with these questions within the British Empire, and shows how the existing deficiency may be partly overcome. There is an exhaustive reference index and bibliography.

Ordnance Survey Maps.—Landowners, farmers and all connected with the land will find the large scale Ordnance Maps of exceptional value. The maps on the scale of 25 in. to the mile show hedges, walls, fences, ditches, roads, paths, streams, houses, woods and orchards, in fact every feature of the countryside, whether natural or artificial.

The acreage of each field or enclosure is also shown. For trifling sums, owners or occupiers of land can obtain thoroughly reliable maps of their properties.

The price per sheet of these large scale maps is 5*s*. The Ordnance Survey also publish maps on the scale of 6 in. to the mile, quarter sheets of which are priced at *1s 6d.*

Several editions of excellent maps on the scale of 1 in. to the mile, and on smaller scales, are also published at prices ranging from 1*s*. to 3*s*. each. All roads are shown ; in the coloured editions, these are classified by means of distinctive colouring according to the nature of their surfaces, including suitability for fast traffic. Footpaths, towns, villages, railways and stations, rivers, streams, parks, woods, county boundaries, high and low watermark, are all accurately delineated. The whole country has been completely surveyed, and the maps are kept up to date by a system of periodic revision. They are specially useful for accuracy of detail and are of the greatest value to those who desire to possess an accurate knowledge of any district or locality in which they are specially interested. The maps can be purchased through any bookseller or stationer, or direct from the Director-General, Ordnance Survey Office, Southampton.

Report of the Departmental Committee on Agricultural Machinery.—(Cmd. 506. London : H.M. Stationery Office, 1920, 1*s*. net). This Committee was appointed by the President of the Board of Agriculture and Fisheries, in May, 1919, to arrange for the testing, adaptation and improvement of machines likely to prove of value to agriculture, to examine inventions and new devices, and to advise as to the further steps which should be taken to promote the development of agricultural machinery.

The Report now published deals with the last part of these terms of reference. The Committee heard evidence from all parties interested in the question of agricultural machinery, and have dealt at some length with various aspects of the problem, including research, testing, co-operation, education and propaganda. An Appendix to the Report contains an outline of the principal steps taken in certain countries abroad to promote the development and use of agricultural machinery.

In another part of this issue (pp. 1 and 2) the recommendations of the Committee are summarised.

Sugar Beet Growing in England.—Much interest is at present being taken in the question of the growth of sugar beet, and the possibilities of the establishment of a beet sugar industry in England as a result of the high price of sugar, the adverse rate of exchange and the insistent demand for increased production of essential food-stuffs. It has, therefore, been thought desirable to set out clearly the present position.

Quite apart from the question of the production of sugar, sugar beet is a useful crop to grow; it would occupy the same place in the rotation as roots without materially, if at all, reducing the supply of succulent food for stock; both leaves and by-products make excellent food for cattle; and the careful and thorough cultivation necessary for the best results reacts favourably on the subsequent crops of the rotation. It has the further important advantage of giving a direct monetary return for its cultivation. Extensive trials conducted before the War have already indicated the suitability of many parts of the country for production of beet on a large scale for manufacture into sugar, but owing to the bulky nature of the crop and the consequent high cost of transport, it must be definitely understood that its growth for the extraction of sugar on a commercial scale is only advisable within reasonable transport distance of a factory.

A beet sugar factory is to be erected on the Kelham Estate in Nottinghamshire,* but there is little likelihood of the factory being completed this year. The Government are financially interested in this enterprise, as they have agreed to take up an equal number of shares with the public up to a maximum value of £250,000 in the company ("Home Grown Sugar, Limited") which has been formed to control the enterprise. The Treasury have a financial representative on the directorate of the company. The nominal capital is to be £1,000,000. £500,000 will be issued and shares to the value of £250,000 have been subscribed by the general public. Communications from farmers with regard to the scheme should be addressed to the Secretary, Home Grown Sugar, Limited, 14, Victoria Street, London, S.W. 1.

There is a sugar factory at Cantley near Norwich, which closed down in 1916 owing to war conditions, but which, it is understood, is now being re-opened. The Ministry understands that new processes are to be installed at the factory, and the machinery overhauled, and it is proposed, by alterations to the plant, to refine cane sugar in periods when beet sugar factories usually stand idle. Inquiries with regard to the growth of beet for this factory should, for the present, be addressed to J. Crosland Graham, Esq., 3, Stanley Street, Liverpool.

A memorandum of the Cultivation of Sugar Beet has been prepared by the Ministry. Copies may be obtained free on application at 72, Victoria Street, London, S.W. 1.

Foot-and-Mouth Disease.—No outbreak of Foot-and-Mouth Disease has been confirmed in Great Britain since the 27th February, on which date there were two outbreaks, one at Ripple (near Tewkesbury) Worcestershire, and one near Wendover, Buckinghamshire, By an Order of the Minister which came into operation on the 29th March, all the remaining general restrictions on the movement of animals, which were imposed by the Ministry in connection with the above and other outbreaks, were withdrawn.

* See note in this *Journal*, January, 1920, p. 1000.

Rabies.—No fresh case of Rabies has been confirmed in Great Britain since the 18th February last, the date of the case mentioned in last month's issue of the *Journal*. All muzzling and movement restrictions remaining in force in the Plymouth Area were withdrawn by an Order which took effect on the 29th March. The metropolitan muzzling area has also been further reduced.

Agricultural Executive Committees and Cultivation of Land Orders.—The Somerset Agricultural Executive Committee recently prosecuted an owner of land for failing to comply with a Cultivation Order served in June last, requiring the land to be ploughed and cleaned by the 2nd of September. The defendant's solicitor pleaded guilty on behalf of his client, but urged in extenuation of the offence that the land was purchased with the object of selling it again, not with the intention of cultivating it, and that delay had occurred in finding purchasers suitable to his client. The Bench imposed a fine of £25 with £10 10s. costs.

An Order determining the tenancy of five fields in the West Riding of Yorkshire has been issued in consequence of the neglected condition of three arable fields comprised in the holding. The West Riding Agricultural Executive Committee state that the Cultivation Orders they have served on the tenant, and the warnings they have given him on many occasions, have had no effect on the state of the cultivation of his land.

A prosecution for disregard of Cultivation Orders issued by the Surrey Agricultural Executive Committee was heard at Guildford on the 12th March. The Orders in question were issued in October and November, 1918, and required that certain arable fields should be cleaned and cultivated in preparation for food crops for the harvest of 1919. Practically nothing was done, however, to carry out these Orders up to the end of 1919. The occupier of the land was fined £50, and his agent, £10. Notice was given that an Appeal would probably be lodged.

Poultry and Egg Prices.—The Poultry and Game (Prices) Order, 1918,* was revoked as from Monday, 22nd March, and as a result all British poultry and game are now free from control.

The Eggs (Prices) Order, 1919†, was also suspended from Monday, 22nd March.

Price of Sugar for Bee-feeding.—The Ministry has been in frequent communication with the Royal Commission on the Sugar Supply on behalf of bee-keepers, and has been informed that the Commission are unable to reduce the price of sugar for bee-feeding below the economic price, or below that at which it is sold for purposes other than grocery and the manufacture of jam, as this would, in effect, be equivalent to paying a subsidy to the bee-keeping industry.

The Ministry regrets this decision, but in view of the general increase in price, bee-keepers cannot expect to receive preferential treatment.

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* See this *Journal*, January, 1920, p. 1033.

† " " December, 1918, p. 1128, and January, 1920, p. 1033.

ADDITIONS TO THE LIBRARY.

Agriculture, General and Miscellaneous—

Ministry of Munitions of War.—Nitrogen Products Committee: Final Report. (357 pp.), [Cmd. 482], London: H.M. Stationery Office, 1920, 4*s.* net. [63.1671; 668.6.]

Sierig, Dr. Ewald.—Die Moorkultur, ihre volkswirtschaftliche Bedeutung und Durchführung. (126 pp.), Berlin: Paul Parey, 1913. [63.142.]

Field Crops—

B. E. Africa Department of Agriculture.—Bulletin 4:—Wheat in East Africa. (16 pp.), Nairobi, 1919. [63.311(04).]

West of Scotland Agricultural College.—Bulletin 95:—Report on Sugar-beet Trials, 1918. (5 pp.), Glasgow, 1919. [63.3432.]

Scandinavian Seed Company and R. Wibolt.—Rules of Proceedings in Determination of Dry Matter in Beet-roots. (4 pp.), Copenhagen: Johann Ullstad, n.d. [63.3432.]

Horticulture—

Brannt, W. T.—A Practical Treatise on the Manufacture of Vinegar and Acetates, Cider and Fruit Wines, and the Preservation of Fruits, Vegetables, etc. 3rd Ed. (543 pp.), Philadelphia: Henry Carey Baird & Co., 1914, 35*s.* [663(*a*); 663.3; 664.8.]

Live Stock—

Board of Agriculture and Fisheries.—Part II. of the Report of the Army Cattle Committee. (7 pp.), London: H.M. Stationery Office, 1919, 2*d.* net. [63.6(42).]

Board of Trade.—Report of Inter-Departmental Committee on Meat Supplies. (29 pp.), [Cmd. 456], London: H.M. Stationery Office, 1919, 3*d.* net. [63.6(42).]

Dairying and Food, General—

National Clean Milk Society.—Lecture on the National Importance of a Clean Milk Supply and How to Obtain It. (11 pp.), London, 1919, 6*d.* [614.32.]

Sammis, J. L.—Cheese Making: a Book for Practical Cheesemakers, Factory Patrons, Agricultural Colleges, and Dairy Schools. (225 pp.), Madison, Wis.: Mendota Book Co., 1918. [63.73(02).]

Birds, Poultry and Bees—

Canada, Dept. of Mines, Geological Survey.—Memoir 104:—Birds of Eastern Canada. (297 pp.), Ottawa, 1919, 50 cents. [59.82.]

Engineering—

Page, V. W.—The Modern Gas Tractor: Its Construction, Utility, Operation and Repair. (504 pp.), New York: N. W. Henley Publishing Co., 1918, $2.00. [63.175.]

Board of Agriculture and Fisheries.—Manual for the Guidance of County Councils and their Architects in the Equipment of Small Holdings: Part I., Planning and Construction of Cottages. Part II., Planning and Construction of Farm Buildings. (53 pp.), London: H.M. Stationery Office, 1919. 1*s.* 6*d.* net. [69(02).]

Economics—

Switzerland, Secrétariat des Paysans.—Recherches relatives à la Rentabilité de l'Agriculture suisse, pour 1917–18. (249 pp.), Lucerne: Keller, 1919. [63(494).]

Ministry of Reconstruction.—Fourth Report of the Acquisition and Valuation of Land Committee on the Transfer of Land in England and Wales [Cmd. 424]. (48 pp.), London: H.M. Stationery Office, 1919. 6*d.* net. [347; 333.]

Central Landowners' Association.—Memorandum on the Tithe Act, 1918. (4 pp.), 1919. [348.]

Central Landowners' Association.—Memorandum on The Nationalisation of Agricultural Land. (9 pp.), 1919. [333.]

Mitchell, E. L.—A Handbook of the Law of Allotments (England and Wales), with Rules and Regulations of the Board of Agriculture and Fisheries. (100 pp.), London: Cable Printing and Publishing Co., 1919. 6s. net. [347(*b*).]

Board of Agriculture and Fisheries.—Report of Sub-Committee appointed to consider the Employment of Women in Agriculture in England and Wales. (121 pp.), London: H.M. Stationery Office, 1919. 1s. 6d. net. [331(*c*).]

SELECTED CONTENTS OF PERIODICALS.

Agriculture, General and Miscellaneous—

Scottish Agriculture during the War, *C. Douglas.* (Trans. High. and Agric. Soc., Scotland, 1919.) [63(41).]

The Carbonation of Burnt Lime in Soils, *W. H. MacIntire.* (Soil Science, May, 1919.) [63.15.]

The Washing out of Nitrates by Drainage Water from Uncropped and Unmanured Land, *E. J. Russell* and *E. H. Richards.* (Jour. Agric. Sci., January, 1920.) [63.1671; 63.112.]

The Relations Existing between the Soil and its Water Content, *B. A. Keen.* (Jour. Agric. Sci., January, 1920.) [63.112.]

Tropical Departments of Agriculture, with special Reference to the West Indies, *Sir F. Watts.* (Jour. Roy. Soc. Arts, 20th and 27th February, 1920.) [35(729); 63(024).]

Seed Studies: Red Clover with special Reference to the Country of Origin of the Seed, *R. G. Stapledon.* (Jour. Agric. Sci., January, 1920.) [63.33(*b*); 63.1951.]

The Determination of Ammonia in Soil, *D. J. Matthews.* (Jour. Agric. Sci., January, 1920.) [63.113.]

Field Crops—

Sunflower Silage, *R. E. Neideg* and *L. E. Vance.* (Jour. Agric. Research, 15th December, 1919.) [63.1985; 63.342.]

Restoration of Land to Pasture, *W. J. Profeit* and *W. M. Findlay.* (Trans. High. and Agric. Soc., Scotland, 1919.) [63.33(*a*).]

Manuring for Milk, *J. M. Adams.* (Jour. Dept. Agric., Ireland, Vol. XX., No. 1, 1919.) [63.33–16.]

The Growing of Forage Crops on Dairy Farms in Denmark, *H. Faber.* (Scottish Jour. Agric., January, 1920.) [63.33; 63.191.]

The Turnip Crop in Scotland, *J. A. Symon.* (Scott. Jour. Agric., January, 1920.) [63.332.]

Flax Cultivation and Manipulation in Fife, *T. Young.* (Scott. Jour. Agric., January, 1920.) [63.34111.]

Effect of Alfalfa on the Fertility Elements of the Soil, as compared with Grain Crops, *C. O. Swanson* and *W. L. Latshaw.* (Soil Science, July, 1919.) [63.33(*c*).]

Plant Diseases—

European Frit Fly in North America, *J. M. Aldrich.* (Jour. Agric. Research, 2nd February, 1920.) [63.27.]

Silver-Leaf Disease, *F. T. Brooks* and *M. A. Bailey.* (Jour. Pomology, Vol. I., No. 2, 1920.) [63.24.]

A Phytophthora Rot of Pears and Apples, *H. Wormald.* (Ann. App. Biol., December, 1919.) [63.24.]

On the Life History of "Wireworms" of the Genus *Agriotes*, Esch., with some Notes on that of *Athous Haemorrhoidalis*, *F.* Part I., *A. W. Rymer Roberts.* (Ann. App. Biol., December, 1919.) [63.27.]

A Contribution to the Life History of the Larch Chermes (*Cnaphalodes strobilobius*, Kalt.), *E. R. Speyer.* (Ann. App. Biol., December, 1919.) [63.27.]

Studies in Bacteriosis, IV.—" Stripe " Disease of Tomato, *S. G. Paine* and *W. F. Bewley*. (Ann. App. Biol., December, 1919.) [63.24.]

A Preliminary Study of the Rust Resistance of Oats, *J. H. Parker*. (Jour. Amer. Soc. Agron., January, 1920.) [63.24.]

The Mosaic Disease of the Solanaceae : Its Relation to Phloem-Necrosis and its Effect on Potato-Culture, *H. M. Quanjer et al.* (Meded. Landbouwhoogeschool, Wageningen, Decl. XVII., Afl. 1–3, 1919.) [63.27–33.]

Live Stock—

The Origin of the Ayrshire Breed of Cattle, *C. Douglas*. (Trans. High. and Agric. Soc., Scotland, 1919.) [63.62.]

Famous Clydesdale Sires (Second Series), *A. Macneilage*. (Trans. High. and Agric. Soc., Scotland, 1919.) [63.61.]

Bracken Rhizomes and their Food Value, *J. Hendrick*. (Trans. High. and Agric. Soc., Scotland, 1919.) [63.604(*a*).]

Weitere Untersuchungen über die Zusammensetzung und Verdaulichkeit einiger Kriegsfuttermittel (Pansenmischfütter, Leimgallertefutter, Maiskolbenschvot, Zuckerrübensamen, Ackerbohnenkleie, Nesselmehl und Zuckerrübenschwanze), *F. Honcamp, O. Nolte*, and *E. Blanck*. (Land. Versuchs-Stationen, Band XCIV., Heft 3 and 4, 1919.) [63.604(*a*).

Scottish Pure Bred Live Stock: II.—Shorthorn Cattle. *W. Mackay*. (Scott. Jour. Agric., January, 1920.) [63.62.]

Dairying and Food, General—

Electro-Pure Process of Treating Milk, *A K. Anderson* and *R. Finkelstein*. (Jour. Dairy Science, September, 1919.) [63.717.]

The Mould of Blue-Veined Cheeses, *D. W. Steuart*. (Jour. Dairy Science, September, 1919.) [63.736.]

Co-operative Dairying in Siberia, *C. W. Holman*. (Better Business, February, 1920.) [334(47).]

A New Method of Testing Cheeses, *A. Geake*. (Jour. Agric. Sci., January, 1920.) [543.2 ; 63.73(04).]

Investigation into Milk Yield of Ayrshire Cows, *J. F. Tocher*. (Trans. High. and Agric. Soc., Scotland, 1919.) [63.711(*b*).]

The Casein Industry : Manufacturing Processes and Methods, *J. Pedersen*. (New Zealand Jour. Agric., December, 1919.) [63.727.]

Veterinary Science—

The Ox Warble or Ox Bot Flies, *R. Stewart MacDougall*. (Trans. High. and Agric. Soc., Scotland, 1919.) [619.2(*f*).]

Birds, Poultry, and Bees—

Egg Pulp and Cool Storage, *A. V. D. Rintoul*. (Jour. Dept. Agric., Victoria, November, 1919.) [63.742.]

Engineering—

Rural Water Supply. (" Housing," 8th and 22nd December, 1919.) [628.7.]

Land Drainage from the Administrative and Engineering Points of View, *E. M. Konstam* and *C. H. J. Clayton*. (Surv. Inst. Trans., Vol. LII., Part III., 1920.) [63.14(04).]

Agricultural Tractors—IV., *R. N. Tweedy*. (Better Business, February, 1920.) [63.175.]

Economics—

Co-operative Farming in Italy, *L. Smith-Gordon*. (Better Business, February, 1920.) [334(45).]

Capital Required for Entry to Farms. (Scott. Jour. Agric., January, 1920.) [338.58.]

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